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PROJECT PLAN: OPERATIONAL EVALUATION OF TERMINAL ATC WITH DABS.(U)

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# NAFEC TECHNICAL REPORT

## PROJECT PLAN OPERATIONAL EVALUATION OF TERMINAL ATC WITH DABS

The MITRE Corporation



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MARCH 1980

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FEDERAL AVIATION ADMINISTRATION  
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N O T I C E

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## PROJECT PLAN

NPD NO. 03-110

SUBPROGRAM 142-176

PROJECT NO. 142-176-530

This project plan has been established as a technical and operational document outlining the effort to be applied in the accomplishment of this project. The project plan was prepared on the basis of the best information available. It is emphasized that this is a research and development effort and that changes in this plan may be necessary as the work progresses. Any such changes will be accomplished by coordination with the Engineering Management Staff and other affected NAFEC elements. Other involved personnel will be advised.

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16. Abstract This report describes a two-phase effort intended to complement the on-going DABS technical tests by assessing the operational implications and man-machine interactions when DABS is integrated with the ARTS III system. The effort includes simulated and live runs with the participation of ATC controllers, and an analytical evaluation of the effect of DABS on aircraft separation requirements, ATC procedures, and controller workload.  (9) Technical rept.		
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# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
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### LENGTH

in	inches	2.5	Centimeters	cm
ft	feet	30	Centimeters	cm
yd	yards	0.9	Meters	m
mi	miles	1.6	Kilometers	km

### AREA

in <sup>2</sup>	square inches	6.5	Square centimeters	cm <sup>2</sup>
ft <sup>2</sup>	square feet	0.09	Square meters	m <sup>2</sup>
yd <sup>2</sup>	square yards	0.8	Square meters	m <sup>2</sup>
mi <sup>2</sup>	square miles	2.6	Square kilometers	km <sup>2</sup>
	acres	0.4	Hectares	ha

### MASS (weight)

oz	ounces	28	grams	g
lb	pounds	0.45	Kilograms	kg
	short tons (2000 lb)	0.9	Tonnes	t

### VOLUME

tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	Liters	l
pt	pints	0.47	Liters	l
qt	quarts	0.95	Liters	l
gal	gallons	3.8	Liters	l
ft <sup>3</sup>	cubic feet	0.03	Cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.76	Cubic meters	m <sup>3</sup>

### TEMPERATURE (exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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## Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
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### LENGTH

mm	millimeters	0.04	Inches	in
cm	centimeters	0.4	Inches	in
m	meters	3.3	Feet	ft
km	kilometers	0.6	Miles	mi

### AREA

cm <sup>2</sup>	square centimeters	0.16	Square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	1.2	Square yards	yd <sup>2</sup>
ha	hectares (10,000 m <sup>2</sup> )	2.5	Square miles	mi <sup>2</sup>

### MASS (weight)

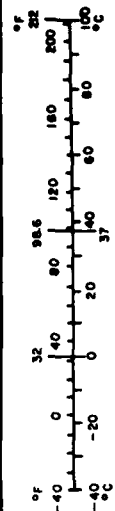
g	grams	0.035	Ounces	oz
kg	kilograms	2.2	Pounds	lb
t	tonnes (1000 kg)	1.1	Short tons	

### VOLUME

ml	milliliters	0.03	Fluid ounces	fl oz
l	liters	2.1	Pints	pt
l	liters	1.06	Quarts	qt
l	liters	0.26	Gallons	gal
m <sup>3</sup>	cubic meters	35	Cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	Cubic yards	yd <sup>3</sup>

### TEMPERATURE (exact)

°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F
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\*1 in. = 2.54 exactly. For other exact conversions and more data and tables, see NBS Mon. Publ. 286, Units of Weights and Measures, Price \$2.25, SO Catalog No. C13.10-286.

## FOREWORD

This document was prepared under a close working relationship between Mr. Verne Tallio of NAFEC and the author. In addition to providing many suggestions and comments, Mr. Tallio was instrumental in developing the test scenarios and organizing the evaluation effort.

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## 1. OBJECTIVES OF DABS/ATC OPERATIONAL EVALUATION

The general objective of the DABS/ATC operational evaluation is to complement the on-going technical tests of DABS and related ATC system changes by assessing the operational and man-machine interaction aspects of DABS/ATC. Thus, this evaluation is primarily concerned with assessing and demonstrating the controller's ability to perform his job effectively and efficiently using the new DABS/ATC system. Specifically, the following aspects of the system are to be evaluated:

### (1) Effects on Separation Requirements

With DABS, and the associated subsystems (e.g., Video Reconstitutor), some of the display characteristics of aircraft radar and beacon data are different from today's ARTS III displays. Some display factors (e.g., position accuracy, target resolution, and processing delays) are directly related to separation assurance. The evaluation effort will seek to verify that the controller can satisfactorily insure adequate aircraft separation using the new DABS/ATC display characteristics.

### (2) Quality of Displayed Surveillance Data

There is a need to collect and analyze controllers' opinions regarding the DABS surveillance quality and to confirm that no unsatisfactory aspects of an operational nature exist in the new surveillance displays. Examples of some areas that need to be evaluated are: The characteristics of full-digital and video-reconstituted displays, radar clutter, and display of weather data.

### (3) Impact on ATC Procedures

It is expected that the field-implementation of DABS will necessitate changes in today's ATC operational procedures. The nature and the extent of these changes need to be determined.

### (4) Impact on Controller Workload

This aspect of operational evaluation will be concerned with verifying that DABS does not impose extra demands on the controller, particularly with regard to the frequency of keyboard entries, flight strip handling, and voice communications. In addition, there is a need to insure that the new system does not include any characteristics which may contribute to increased controller stress, workload, or affect his ability to comprehend the "ATC picture" in any way.

(5) Acceptability of New Display Characteristics

DABS introduces many new features in the contents and format of the information displayed on the controller's scope. This activity will include the gathering and analysis of controllers' opinions as to the suitability of the displayed data. Each of the new display characteristics will be examined in order to identify and correct any potential problems or weaknesses, and to explore areas where future improvements can be implemented.

(6) Acceptability of New Keyboard Entries

Several new controller keyboard entries are provided in the ARTS III version which will interface with DABS. In addition, some changes were made to the existing ARTS III keyboard entries. This activity will include the gathering and analysis of controllers' opinions, to insure the operational acceptability of the new features of the keyboard entries.

## 2. BACKGROUND

### 2.1 General

DABS, currently being developed by the FAA, is intended to provide improved aircraft surveillance through the following: use of a unique address for each aircraft; monopulse direction finding; reduced synchronous garbling; reduced false, split, and lost targets; and other technical advantages. In addition, DABS will provide extensive data-link communications supporting various ATC automation services, such as automated traffic advisory messages. DABS is designed to be fully compatible with the present ATCRBS capability, so as to permit an extended and economic evolution of the ATC system.

The three DABS engineering models have been undergoing extensive technical testing, primarily at NAFEC and its adjacent facilities (i.e., Elwood and Clementon, NJ). As part of these activities, the NAS en route and ARTS III systems are being modified in order to accommodate the new interfaces required with DABS.

The results of these testing activities will support the Technical Data Package (TDP) which is due to be issued by the FAA in April 1980. The TDP will serve as a basis for procuring the production version of DABS. In addition to complementing the technical testing effort, it is expected that the operational evaluation tests, described in this report, will result in additional meaningful data on issues which specifically relate to the operational viability of the DABS/ATC system (see Section 1).

### 2.2 Scope

The operational evaluation effort will be limited by the following aspects:

#### (1) DABS/ARTS III

Only the DABS/ARTS III interface, as developed and tested at NAFEC, will be used for evaluation. This refers to the modified single beacon ARTS III system with the TABG tracker. The DABS/ARTCC interface will not be used in this effort.

(2) Surveillance Functions

The operational evaluation will be primarily concerned with the surveillance features of the DABS/ARTS III system. The DABS data-link capability will not be included in the evaluation, except for the following two messages which are surveillance-related:

- (i) ATCRBS ID REQUEST
- (ii) ATCRBS ID CODE

(3) NAFEC Tests

All tests will be conducted at NAFEC. DABS or other equipment not located at NAFEC will not be used.

(4) Normal Operations

The tests are designed to evaluate DABS/ARTS under normal operating conditions. No failure modes will be intentionally introduced in the test scripts.

(5) Philadelphia Environment

Tests will be configured to simulate the Philadelphia International Airport operations. This includes the airport adaptation, traffic mixes, flight patterns, and ATC procedures.

(6) Frozen System

Since this evaluation will require the participation of several controllers and observers during the test missions, it is necessary that the tests be run smoothly and efficiently. Therefore, an essential prerequisite for the operational evaluation effort is that all systems being used will have been adequately tested technically, and found to be reasonably ready for operational evaluation. Also, it is expected that, at the time of testing, all system parameters will be set at their nominal, or most reasonable, values, and no known hardware or software problems or malfunctions will exist.

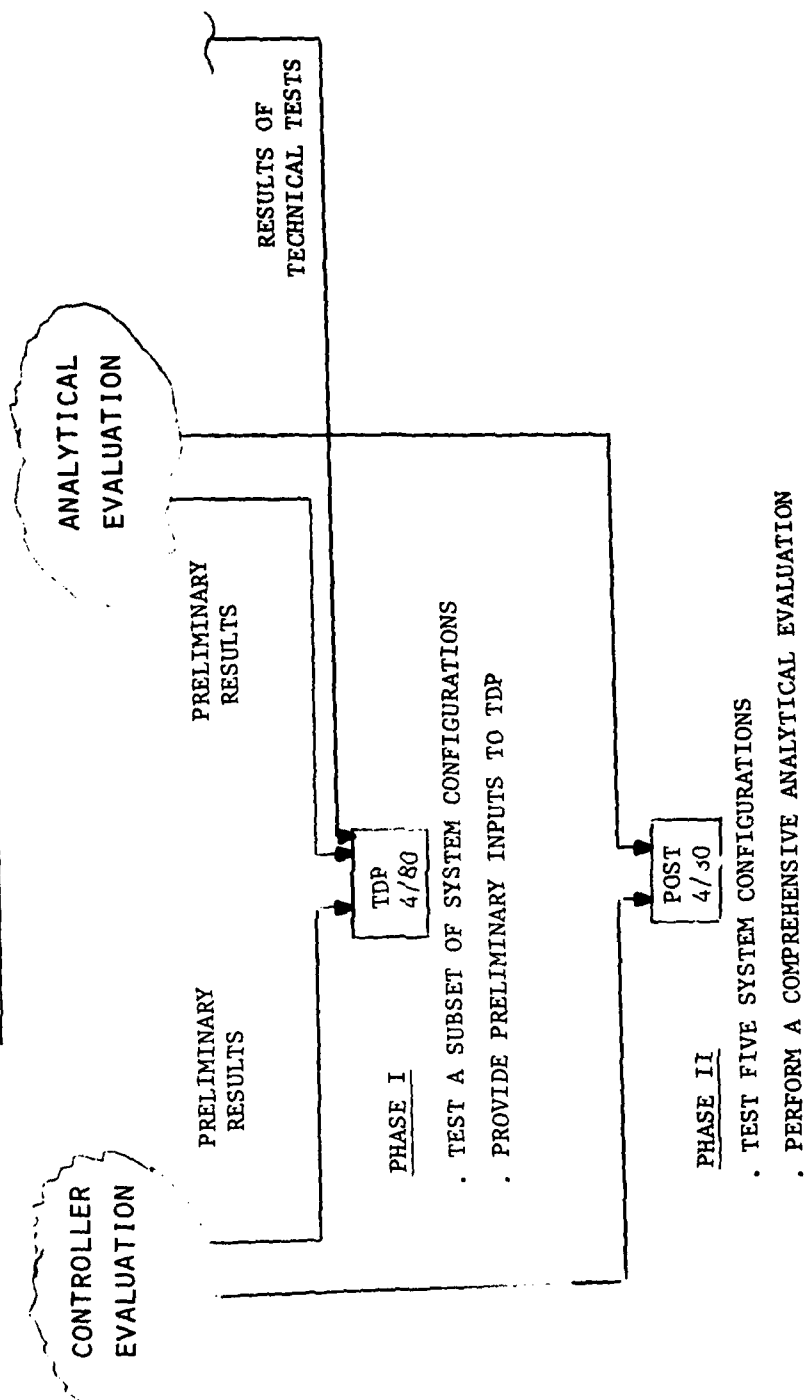
### 2.3 Evaluation Phases

The operational evaluation effort is envisioned to consist of two major phases:

- Phase I: Preliminary Controller Evaluation (pre-TDP)
- Phase II: Operational Impact Analysis (post-TDP)

As depicted in Figure 2-1, Phase I will provide preliminary results prior to publication of the TDP, scheduled for April 1980. If some of the system configurations (see Section 4.3) are not available for testing prior to the issuance of the TDP, these configurations will be tested as part of the Phase II effort. In addition, Phase II will include a comprehensive analytical evaluation of the major operational aspects of the DABS/ATC system (see Section 5.2.2.2). The controller evaluation effort under Phase I will be accomplished with controllers from the NAFEC staff. These controllers may also take part initially in tests conducted under Phase II. Subsequently, controllers from operational ARTS III sites will be invited to NAFEC for a final evaluation of the various configurations.

FIGURE 2-1  
METHODOLOGY





### 3. RELATED DOCUMENTATION

1. ATC-10309, Sperry UNIVAC, "DABS Computer Program Functional Specifications", Draft Report, December 1979.
2. ATC-10300, Sperry UNIVAC, "DABS/SRAP II/ARTS III Design Data".
3. Project 1431B, FAA, "Test Plan: DABS/ATC System Technical Tests for Terminal Surveillance", June 1979.
4. PHL 7110.23B, Philadelphia Tower, Standard Operating Procedures Handbook.

#### 4. SYSTEM/EQUIPMENT DESCRIPTION

##### 4.1 General

The DABS/ARTS III system can operate with Full-Digital (F/D) displays or with the present Time-Share (T/S) displays. These two basic concepts are illustrated in Figures 4-1 and 4-2, respectively. Beacon inputs are processed through the DABS sensor. Search data are processed through a digitizer, i.e., MTD or RDAS, or directly displayed on a T/S scope through the Video Delay Generator without any DABS processing. The Video Reconstitutor provides reconstituted beacon or primary raw video data on the ARTS T/S PPI display. Two simulation vehicles, ARIES and ATCSF, can be used with the basic configurations to generate input signals based on prescribed traffic scenarios.

##### 4.2 Overview of Subsystems

A brief overview of each of the major subsystems used in the evaluation is provided below:

###### (1) DABS

The engineering model of DABS installed in building 269A at NAFEC will be used. This system includes the DABS antenna and sensor equipment, surveillance and communications processing computers, and off-line software support capabilities. A detailed description of DABS can be found in FAA-RD-74-189, "DABS: A System Description".

###### (2) ARTS III

The system used in the performance evaluation effort will be a version of the ARTS III system modified to interface with DABS. In addition to processing the DABS surveillance and communications messages, the modified system includes major differences from today's ARTS III, primarily: Tracking of all beacon as well as search-only targets, whether associated or non-associated; an improved tracker--the Thresholded Alpha Beta Gamma Tracker (TABG); new display characteristics, notably, an all digital display capability; and new keyboard entries. This system is described in ATC-10300, Sperry UNIVAC, "DABS/SRAP II/ARTS III Design Data". The Computer Program Functional Specifications are documented in ATC-10309.

FIGURE 4-1  
**BASIC CONFIGURATION (I)**  
**WITH F/D DISPLAYS**

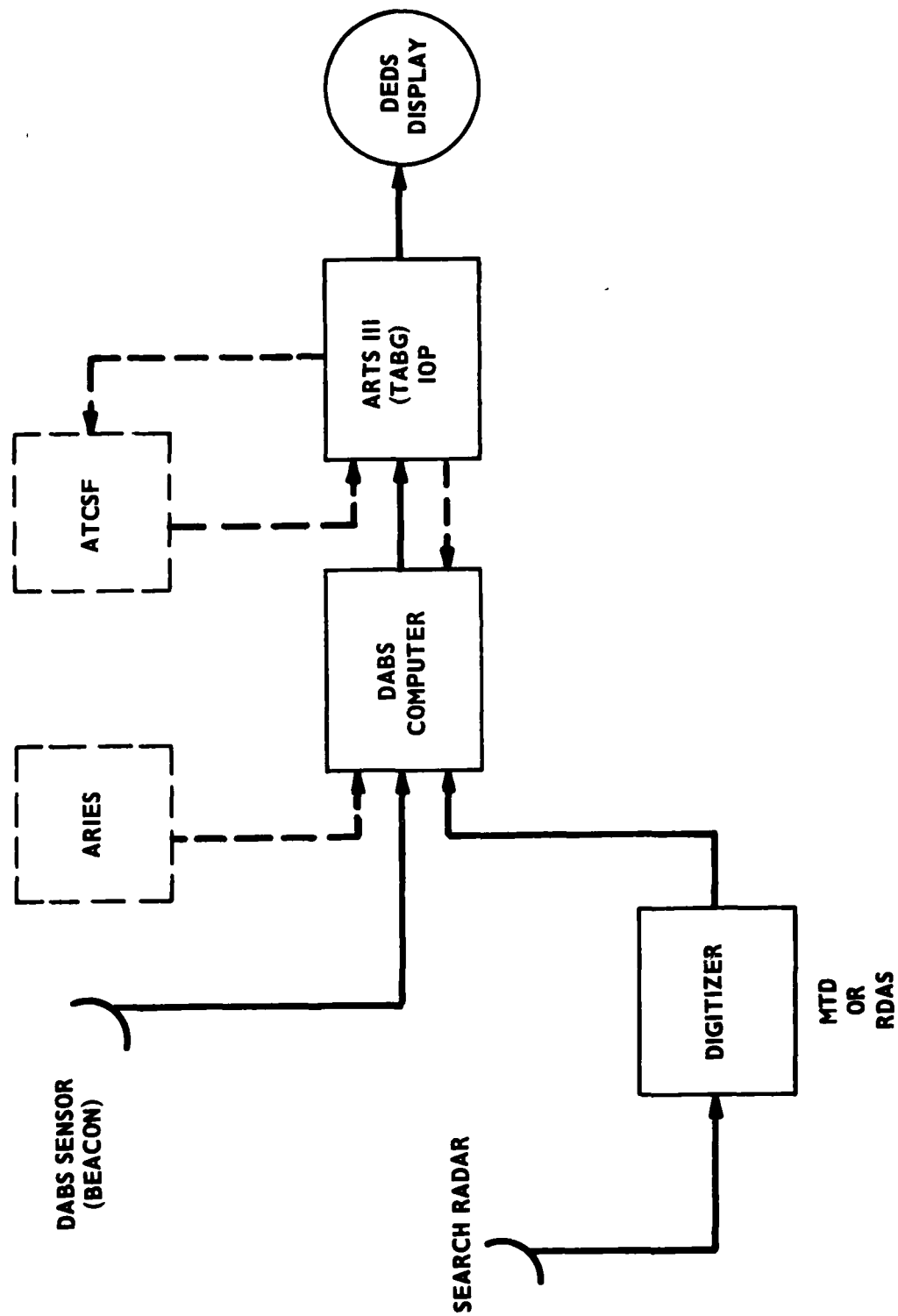
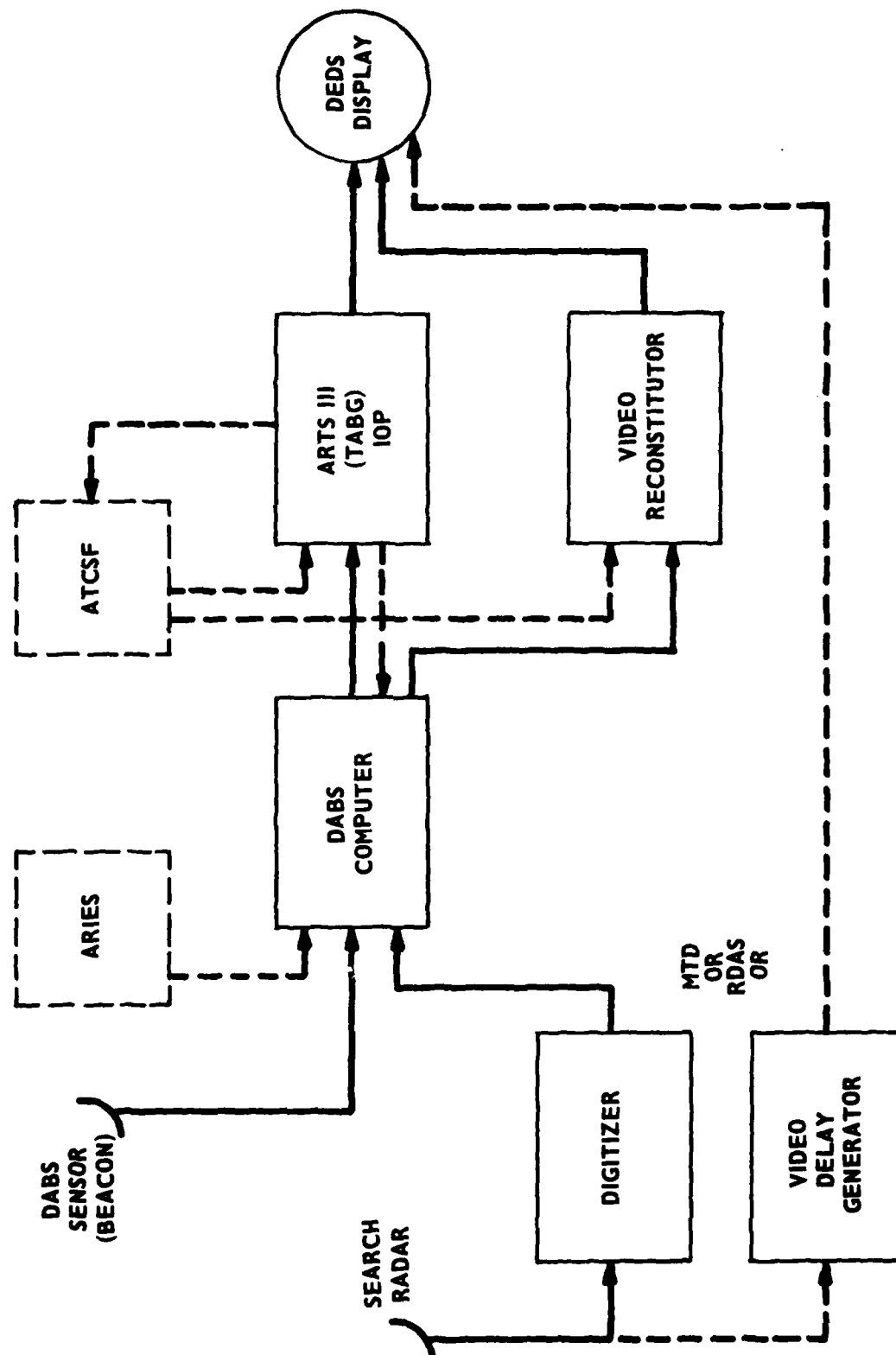


FIGURE 4-2  
BASIC CONFIGURATION (2)  
WITH T/S DISPLAYS



(3) Video Delay Generator

The Video Delay Generator is a unit that provides delay of primary radar video signals. This is done to provide registration of these signals with the DABS reconstituted video output. The primary radar video is provided to an ATC facility served by a DABS sensor that does not have digitized primary radar inputs. The unit is combined in the same physical package as the Video Reconstitutor, but it is functionally independent.

(4) Video Reconstitutor

The purpose of the Video Reconstitutor is to provide reconstituted beacon and reconstituted radar video to an ARTS facility for display on the PPI. The Video Reconstitutor converts the digital DABS output surveillance messages to rho-theta ATCRBS beacon, radar, and weather video formats for use on ARTS III time-shared display. All DABS messages are input to the Video Reconstitutor in the format of ATCRBS messages.

(5) MTD

The Moving Target Detection subsystem was developed by the FAA for the purpose of improving primary radar target detection in the presence of clutter, e.g., ground clutter, precipitation clutter or angle clutter. The MTD was tested in the ARTS II site at Burlington, VT. The MTD provides digital weather messages and radar target reports for processing by DABS. A detailed description of the MTD is provided in FAA-E-2704, "Airport Surveillance Radar, ASR-9", November 1979.

(6) RDAS

The Radar Digital Acquisition System processes primary radar data and outputs digital weather data and target report messages for use by DABS. RDAS data is in the same general format as the MTD data. RDAS and MTD are two alternatives for processing and digitizing of primary radar data. A detailed description of RDAS is provided in PX-12106, Sperry UNIVAC, "Technical Manual for Sensor Receiver and Processor," September 1978.

(7) ATCSF

The ATC Simulation Facility at NAFEC has been programmed to generate simulated DABS output messages, thus driving the ARTS III system in a simulated DABS/ARTS III interface. The controllers manning the ARTS III displays in the TATF are in telephone contact with simulated pilots in the ATCSF building. The simulated pilots affect the flight pattern of the simulated aircraft by making keyboard entries according to the instructions issued by the controllers. The ATCSF is described in "Digital Simulation Facility, User's Guide", Simulation and Analysis Division, NAFEC.

(8) ARIES

The Aircraft Reply and Interference Environment Simulator generates simulated aircraft replies, feeding them to the DABS sensor at Intermediate Frequency (IF), according to a pre-scripted traffic scenario on tape. ARIES can simulate any mix of ATCRBS and DABS transponders. In addition to the beacon data, ARIES provides simulated digitized radar data in the output format of the Common Digitizer (CD) corresponding to the simulated beacon targets. A detailed description of ARIES can be found in FAA-RD-78-96, "The Aircraft Reply and Interference Environment Simulator", Volumes 1, 2, 3.

(9) Airborne TACAN

The airborne Tactical-Air-Navigation aid system--to be used in the live-flight tests (see Section 5.1.3.3)--was designed to display and record air-to-air distance and bearing measurements. The system used at NAFEC is designated Hoffman AN/ARN-84(V). The air-to-air TACAN does not involve any of the ground TACAN frequencies, nor is the TACAN ground station involved in the air-to-air link. The airborne digital TACAN outputs are recorded on magnetic tape for subsequent processing and data reduction. Based on flight tests performed at NAFEC, it was concluded that the air-to-air ranging measurements exhibited zero bias, with a standard deviation error of less than 100 feet. A good description of this equipment can be found in FAA-RD-77-59, "Accuracy Test of an Air-to-Air Ranging and Bearing System", and in FAA-NA-79-32, "NAFEC Range Instrumentation Systems".

#### 4.3 Test Configurations

The combined DABS/ARTS system can be structured in one of five basic system configurations. Each of these configurations has unique characteristics primarily with respect to the features of the surveillance data being displayed on the controller's scope. An explicit objective of the effort described in this plan is to provide a comparative evaluation of the advantages and disadvantages of each of the five configurations. These configurations are as follows:

(1) Configuration #1: F/D Display & MTD (Figure 4-3)

In this configuration the MTD processes and digitizes raw search data, which is then processed by DABS together with the DABS and ATCRBS beacon data obtained through the DABS sensor. The DABS output is processed by the ARTS III system, which includes the TABG tracker. The displayed data on the controller's scope is exclusively digital. Unlike today's ARTS III, no raw video data is displayed in this configuration.

(2) Configuration #2: F/D Display & RDAS (Figure 4-4)

This configuration is the same as (1) above except that the search radar data is processed and digitized by the RDAS equipment instead of the MTD.

(3) Configuration #3: T/S Display & MTD & Video Reconstitutor (Figure 4-5)

In this configuration the T/S displays are used instead of the F/D displays in configurations #1 and #2. Reconstituted primary and beacon video is produced by the Video Reconstitutor unit to simulate the kind of raw video displayed on today's ARTS III PPI.

(4) Configuration #4: T/S Display & RDAS & Video Reconstitutor (Figure 4-6)

This configuration is the same as (3) above except that the RDAS is used to process and digitize search data instead of the MTD.

FIGURE 4-3  
CONFIGURATION #1: F/D DISPLAY & MTD

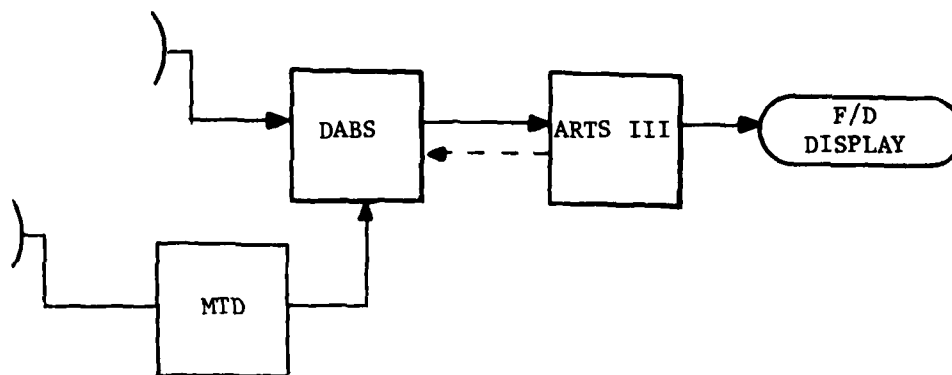


FIGURE 4-4  
CONFIGURATION #2: F/D DISPLAY & RDAS

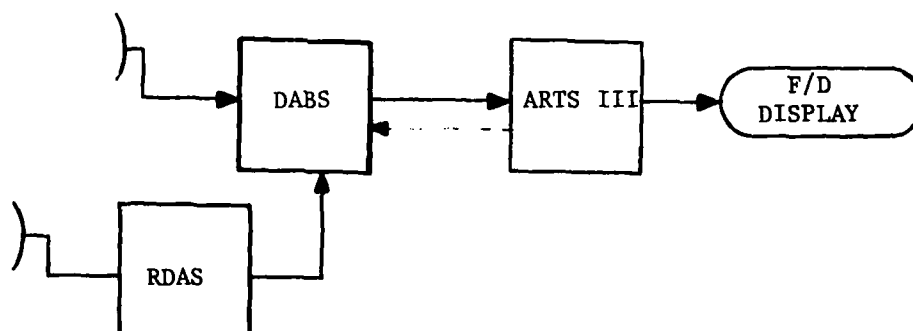




FIGURE 4-5

CONFIGURATION #3: T/S DISPLAY & MTD & VIDEO RECONSTITUTOR

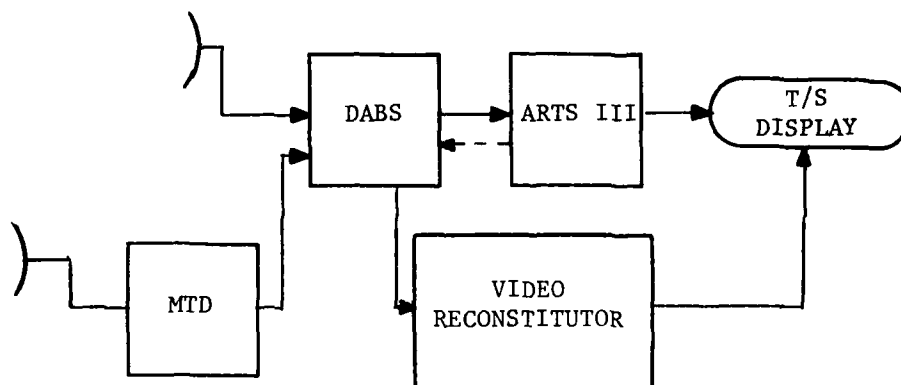
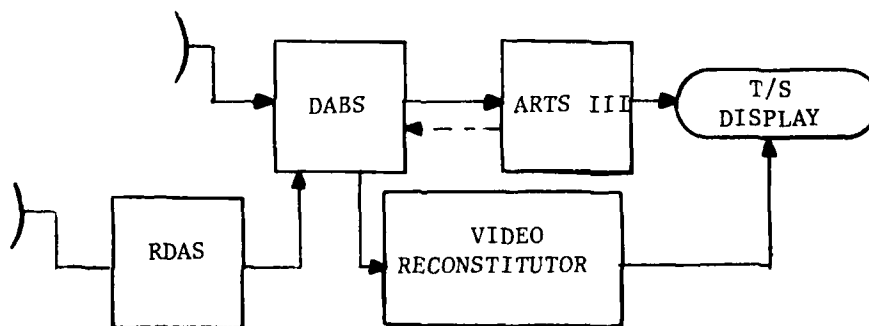


FIGURE 4-6

CONFIGURATION #4: T/S DISPLAY & RDAS & VIDEO RECONSTITUTOR

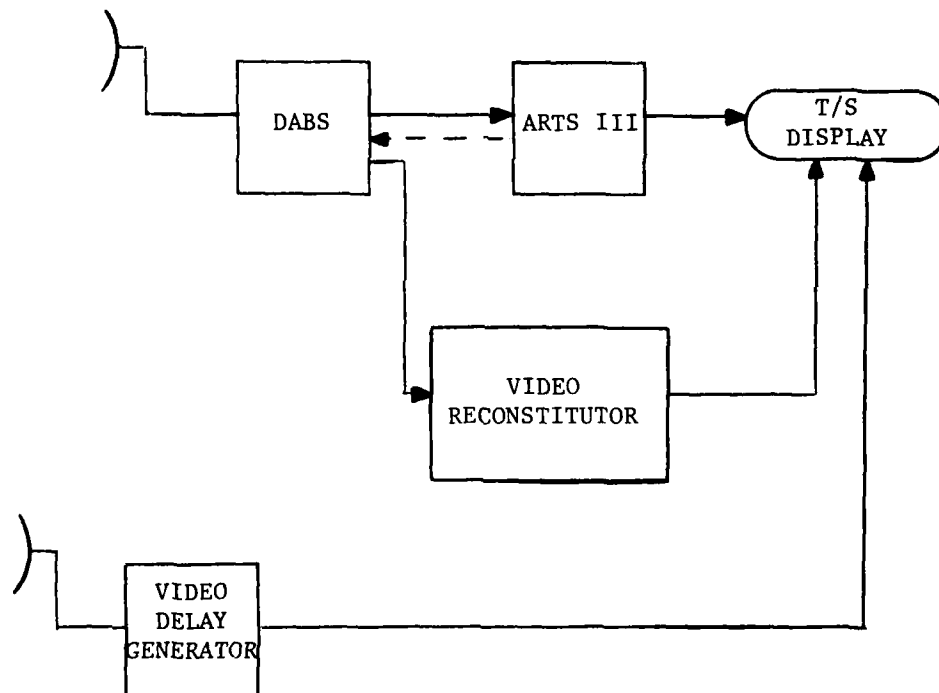


(5) Configuration #5: T/S Display & Video Delay Generator & Video Reconstitutor (Figure 4-7)

In this configuration neither the MTD nor the RDAS is used to digitize the radar data. Instead, the primary data is directly displayed on the controller's scope after a delay sufficient to insure the registration of the primary data with the reconstituted beacon video produced by the Video Reconstitutor.

FIGURE 4-7

CONFIGURATION #5: T/S DISPLAY & VIDEO DELAY GENERATOR &  
VIDEO RECONSTITUTOR



## 5. DATA COLLECTION

As previously discussed (see Section 2.3), the overall operational evaluation will be carried out in two sequential phases. Subsection 5.1 below describes the activities to be performed under Phase I; subsection 5.2 describes the Phase II effort.

### 5.1 Phase I: Preliminary Controller Evaluation (Pre-TDP)

#### 5.1.1 General

The major outcome from Phase I will be a compilation of controllers' opinions on the suitability of the DABS/ARTS III system from an operational point-of-view. In addition to such subjective assessment of the system, any objective results obtained in the course of testing will also be provided in the final report. These may include such items as quantitative measures of surveillance accuracy, identification of suggested changes to future ATC procedures in facilities with DABS coverage or adjacent facilities, and uncovering any operationally-related areas which may have been overlooked during previous test efforts or analyses.

The intended purpose of the Phase I effort is to generate data relevant to the TDP, scheduled for 4/80. Due to the tight schedule, and the possible non-availability of some of the test configurations (see Section 4.3), Phase I should not be considered to be a comprehensive operational evaluation of DABS/ARTS III; rather, Phase I is envisioned as a preliminary activity, with final results to be provided at the completion of Phase II.

#### 5.1.2 Methodology

Under Phase I, a number of test missions will be run using the various configurations of the DABS/ARTS III system. In the event that some of the five test configurations are not available before 4/80, the tests will use only those configurations whose technical tests will have been completed successfully. There will be several simulated as well as live-flight sessions, using the actual DABS/ARTS III equipment. The simulated runs will be made using the ARIES unit, and the ATCSF, as alternative test vehicles. The live tests will be run using two DABS-equipped aircraft, carrying on-board instrumentation (i.e., Hoffman TACAN AN/ARN-84(V)) for measuring and recording the exact separation between the test aircraft.

All radar displays used in the tests will be manned by controllers and observers selected from NAFEC personnel with prior operational experience. Field controllers will not be required for the Phase I tests. The test participants will be requested to fill out detailed questionnaires which will specifically address all the relevant items subject to evaluation. In addition, a debriefing questionnaire will be filled out, supplemented by a general discussion of test results and controllers' observations and comments. Various data will be automatically collected during the tests for subsequent reduction and analysis (see Section 5.1.5.4).

### 5.1.3 Test Modes

Three test modes will be used: ARIES, ATCSF, and live-flight. These are described below.

#### 5.1.3.1 ARIES\*

##### Description (Figure 5-1)

In the ARIES mode, simulated beacon (DABS and ATCRBS) targets will be used based on the traffic scenario, and in addition, targets of opportunity will be processed. At least one test will be run for each of the available test configurations (see Section 4.3). The ARIES will simulate realistic radar noise (i.e., jitter and blip/scan) and fruit. The tests will be run in both VFR and IFR weather conditions.

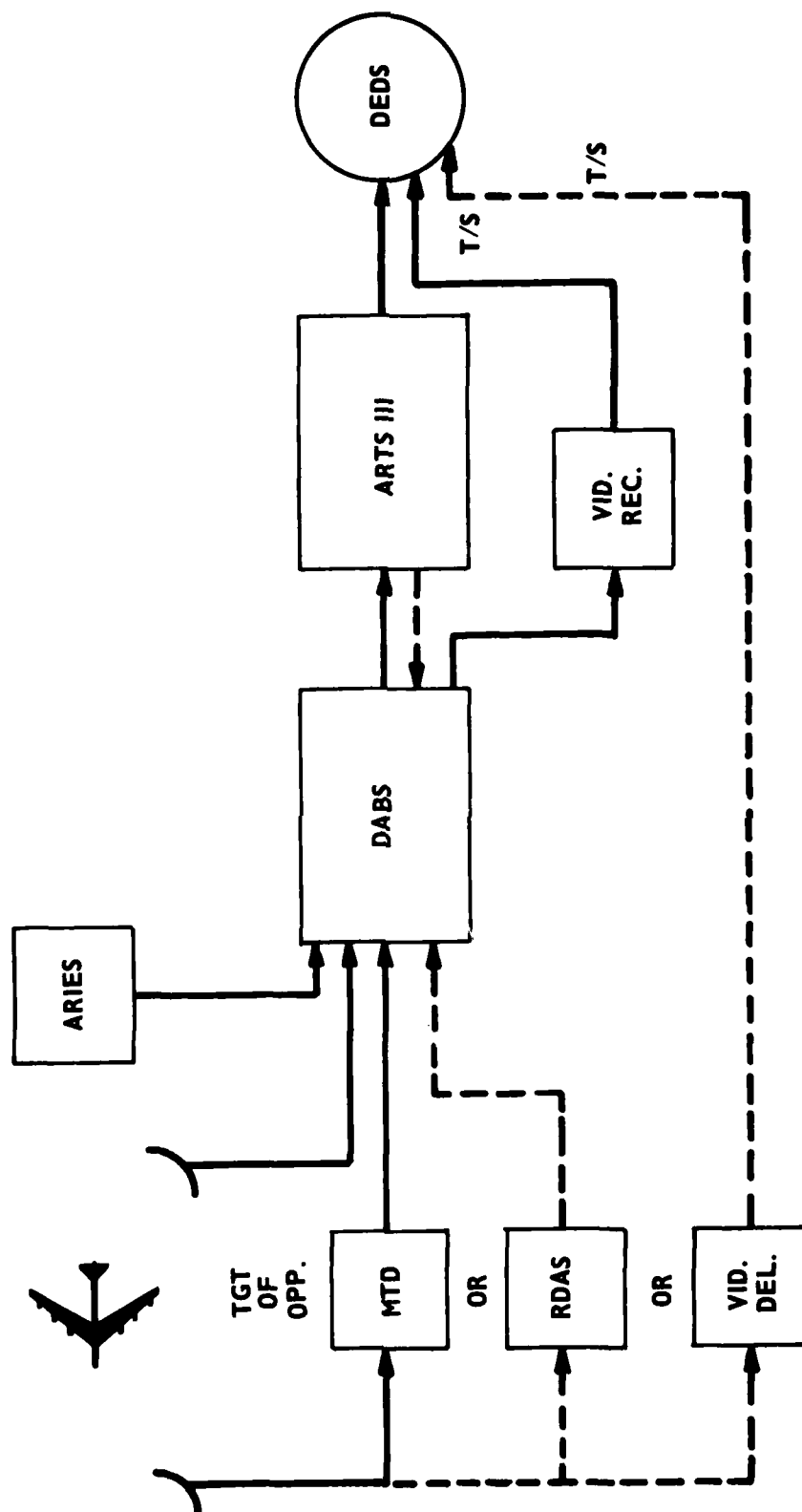
##### Purpose

The ARIES mode will be used to familiarize the test participants (i.e., controllers and observers) with the basic characteristics of the DABS/ARTS III system. Since ARIES does not readily permit on-line entries of aircraft maneuvers (other than those specified in the pre-scripted scenario), this test mode will be "passive" in the sense that the controllers will not control or communicate with the test aircraft. Rather, they will observe and evaluate the display characteristics and other operationally-significant implications of DABS.

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\* ARIES mode also implies the surveillance and evaluation of targets-of-opportunity.

FIGURE 5-1  
TEST MODE I - ARIES



SIMULATE RADAR NOISE  
TEST WITH ALL CONFIGURATIONS  
IFR AND VFR WEATHER

### Scenarios

The ARIES test scenario is described in Appendix A. In general, the scenario has the following characteristics:

- (1) Realistic Philadelphia environment and traffic pattern  
(runways 27R for arrival, 27L for departures)
- (2) 50% DABS aircraft  
50% ATCRBS aircraft
- (3) 60 arrivals, 20 holds  
60 departures  
20 over-flights
- (4) 90% controlled  
10% uncontrolled
- (5) Reply Probability:  
Primary: 85%  
Beacon: 95%
- (6) Fruit rate:  
4K per second
- (7) Test Duration:  
2 hours

### Prerequisites

The following items must be accomplished prior to the actual tests:

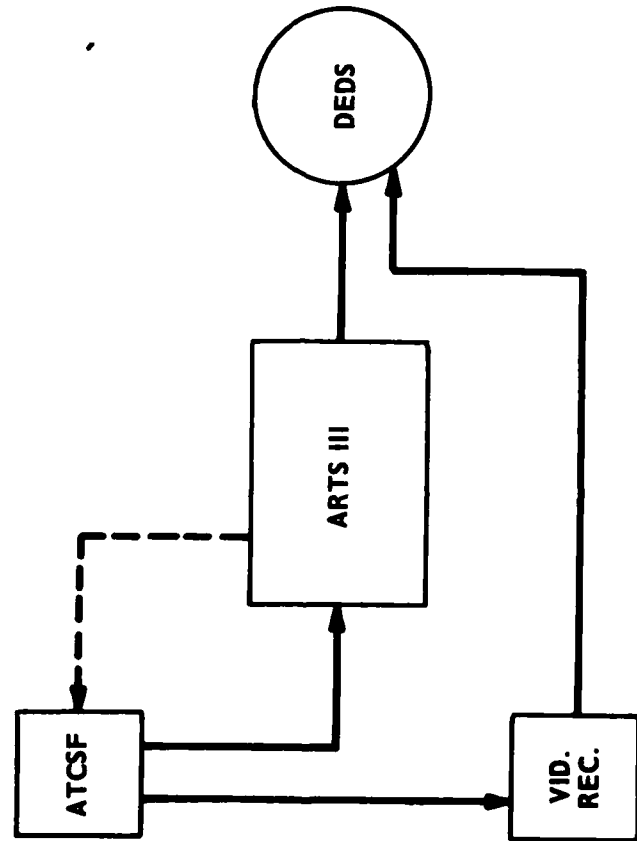
- (1) Scenario preparation and verification
- (2) Testing and verification of the total system as shown in Figure 5-1.

#### 5.1.3.2 ATCSF

##### Description (Figure 5-2)

The ATCSF simulates the DABS computer in that DABS-formatted target reports are generated and shipped to the ARTS III system for processing. In addition, the ATCSF is presently being modified to generate input signals for the Video Reconstitutor. This will make it possible to display simulated beacon and primary video in addition to the alphanumeric information produced by ARTS III.

FIGURE 5-2  
TEST MODE 2 - ATCSF



SIMULATE DABS COMPUTER  
2 SCENARIOS (MEDIUM/HEAVY)  
SIMULATE RADAR NOISE  
REALISTIC PHIL SCENARIO (ARR/DEP/HOLDS/OVERS)



### Purpose

The ATCSF provides the capability to simulate the interactions between controllers and pilots. Thus, the ATCSF is suitable for an "active" simulation, meaning that the controller assumes an active role in controlling the actual maneuvers undertaken by the simulated aircraft.

The major areas which will be evaluated in the ATCSF mode will be:

- (1) The acceptability of the new and modified keyboard entries
- (2) The effect of DABS on controller workload
- (3) The effect of DABS on ATC procedures.

### Scenarios

Two traffic scenarios will be developed for the ATCSF test mode (see Appendix B). Scenario #1 will represent medium load, and scenario #2 will be heavy load traffic. The scenarios will have the following characteristics:

- (1) Realistic Philadelphia Airport environment and traffic pattern
- (2) 30% DABS aircraft  
50% ATCRBS aircraft  
20% search-only aircraft
- (3) 90% controlled aircraft  
10% uncontrolled
- (4) Radar Noise:  
Range jitter: 50 feet rms  
Azimuth jitter:  $0.10^{\circ}$  rms  
Blip-scan: 95%
- (5) Test Duration:  
2 hours

### Prerequisites

The following items must be accomplished prior to the actual tests:

- (1) Completion and verification of the ATCSF software changes, primarily the newly developed interface with the Video Reconstitutor

- (2) Completion and check-out of the test scenarios
- (3) Testing and verification of the total system as shown in Figure 5-2.

#### 5.1.3.3 Live-Flight

##### Description (Figure 5-3)

In the live-flight mode, two DABS-equipped aircraft will fly a prescribed flight course around NAFEC. Hoffman AN/ARN-84(V) airborne TACAN equipment will be used to obtain the proper lateral separation. The separation, as measured by this equipment, will be compared against the separation as visually observed on the controller's display, and subsequently will be analyzed to obtain a quantitative measure of the deviations between the true separation and the displayed separation (see Section 6).

Two ARTS III systems (i.e., systems #1 and #3) at the TATF will be used simultaneously to facilitate a "side-by-side" comparative evaluation of the ARTS III system with and without DABS. The ASR facility used for the ARTS III display will be configured and calibrated to represent a realistic ARTS III radar capability.

In addition to the two test aircraft, all targets of opportunity will be displayed on the two systems for comparative evaluation. Weather permitting, tests will be run in both IFR and VFR conditions.

##### Purpose

The live-flight tests will be used to demonstrate the differences in the displayed video and alphanumeric data before-and-after DABS. Also, for the DABS/ATC system, the accuracy of the displayed aircraft position and relative separation will be evaluated subjectively as well as quantitatively. The resolution of two targets in proximity will also be subject to assessment.

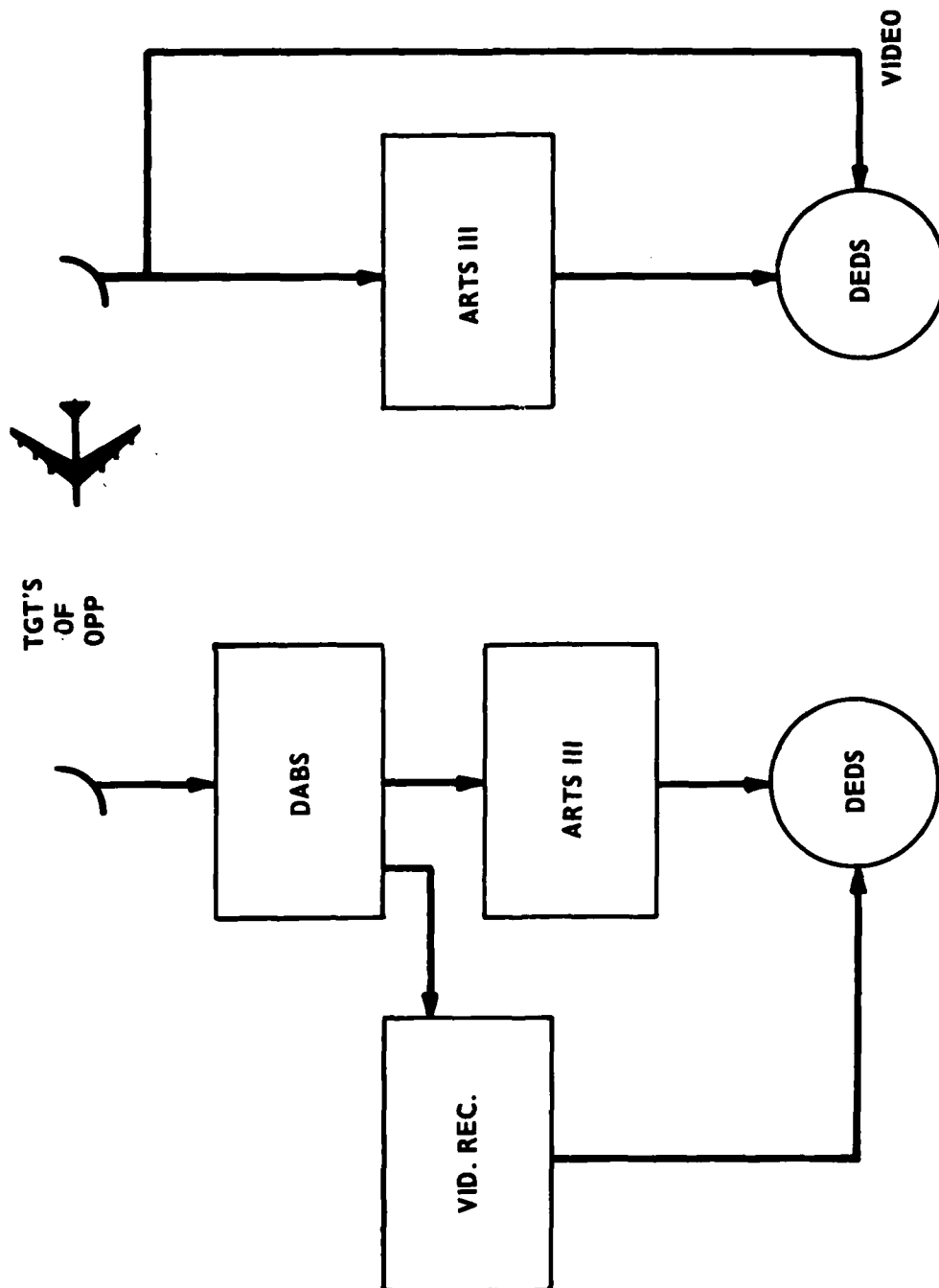
##### Scenarios

The flight plans of the two test aircraft are illustrated in Appendix C. The flight paths were designed to achieve the following flight patterns:

- (1) Parallel flights, tangential and radial to the radar antenna, with varying fixed lateral separations:

4 nm  
3 nm  
2 nm

FIGURE 5-3  
TEST MODE 3 - LIVE FLIGHT



SIDE-BY-SIDE DISPLAYS  
ON-BOARD INSTRUMENTATION  
TEST WITH ALL CONFIGURATIONS  
IFR AND VFR WEATHER  
SPECIALLY-DESIGNED FLIGHT SCRIPT

- (2) Overtakes
- (3) Head-ons
- (4) 30° crossovers

These patterns will be accomplished at various distances from the radar antenna, namely: 5, 20, and 40 nm. The flight tests will be repeated at two altitudes: 5,000 and 12,000 feet.

The tests will include periods in which the aircraft represent (selectively) different transponder equipment: DABS-equipped, ATCRBS-equipped, or no beacon (i.e., search only).

#### Prerequisites

The following items must be accomplished prior to the actual tests:

- (1) Completion and check-out of the flight plans
- (2) Coordination with the Eastern Region
- (3) Scheduling of pilots and test aircraft
- (4) Preparation of pilot test procedures
- (5) Preparation of controller test procedures
- (6) Testing and verification of the total system as shown in Figure 5-3. Also, testing and verification of the airborne instrumentation equipment.

#### 5.1.4 Test Missions

The number of test missions depends on the readiness of the equipment required for each of the five system configurations described previously (Section 4.3). Since a firm statement stipulating which configurations will be available is not possible at this time, three contingency plans were identified depending on the test equipment readiness. Eventually, all five configurations will be tested by both NAFEC and field controllers. However, the sequence of the tests depends on equipment availability. Whatever results are obtained by 4/80 will be applied to support the TDP, but the test effort will continue past the TDP publication.

#### Contingency I: All Systems Ready

If all five system configurations are available for operational evaluation according to this plan, sixteen test missions will be needed as listed in Figure 5-4.

FIGURE 5-4 TEST MISSIONS: CONTINGENCY PLAN I

ASSUMPTION: ALL SUBSYSTEMS WILL BE READY BEFORE 3/80

MISSION	MODE	PURPOSE
1	ARIES*	EVALUATE F/D WITH MTD
	F/D - MTD	
2	ARIES	EVALUATE F/D WITH RDAS
	F/D - RDAS	
3	ARIES	EVALUATE T/S WITH MTD
	T/S-MTD-VID. REC.	
4	ARIES	EVALUATE T/S WITH RDAS
	T/S-RDAS-VID. REC.	
5	ARIES	EVALUATE T/S WITH VID. DEL.
	T/S-VID. DEL.-VID. REC.	
6 - 8	ATCSF	REALISTIC SCENARIOS
9 - 11	ATCSF WITH VID. REC.	REALISTIC SCENARIOS
12 - 16	LIVE*	SAME AS 1-5 BUT WITH LIVE TEST AIRCRAFT SIDE-BY-SIDE EVALUATION

\* "ARIES" AND "LIVE" IMPLY ALSO TARGETS OF OPPORTUNITY

#### Contingency II: Only Video Delay Generator and Video Reconstitutor

This contingency represents the most basic configuration which must be available in order to run the operational evaluation. Eight test missions will be required as listed in Figure 5-5.

#### Contingency III: Contingency II Equipment Plus MTD

This contingency will require twelve tests as listed in Figure 5-6.

#### 5.1.5 Test Conduct

##### 5.1.5.1 Controller Procedures

As guidance to the participating test controllers, a set of controller procedures will be developed for each mission. The procedures will identify: (1) general control guidelines, e.g., handoffs, keyboard entries, airport geometry rules, and (2) special actions required in a test, e.g., "request change to ATCRBS", "record observed separation", "note whether pilot's reported position at fix XXX corresponds with observed position".

##### 5.1.5.2 Pre-Briefing

Each mission will be preceded by a pre-briefing session in which a general description of the test will be presented, as well as test objectives, procedures, and assignments.

##### 5.1.5.3 Controller and Observer Functions

Each radar scope (or a pair of scopes in the side-by-side test) will be manned by at least two people: a controller and an observer. The controller is responsible for executing the test procedures, filling out the entries on the questionnaire form, and, in general, observing the scope and noting on the form or verbally any peculiarities or display characteristics which are different from today's ARTS III system.

The observer function during the tests is to record on the observer log the controller comments as well as his own observations of the display characteristics or controller actions.

##### 5.1.5.4 Data Gathering

The collected data, which will be subsequently used for analysis, include both manually and automatically collected data, as follows:

FIGURE 5-5 TEST MISSIONS: CONTINGENCY PLAN II

ASSUMPTION: ONLY VID. DEL. GEN. AND VID. REC. WILL  
BE READY BEFORE 3/80.

TEST MISSIONS:

<u>MISSION</u>	<u>MODE</u>
5	ARIES T/S & VID. DEL. & VID. REC.
6-8	ATCSF
9-11	ATCSF WITH VID. REC.
16	LIVE

FIGURE 3-6 TEST MISSIONS: CONTINGENCY PLAN III

ASSUMPTION: ONLY MTD AND VID. DEL. GEN. AND VID. REC.  
WILL BE READY BEFORE 3/80

TEST MISSIONS:

<u>MISSION</u>	<u>MODE</u>
1	ARIES F/D & MTD
3	ARIES T/S & MTD & VID. REC.
5	ARIES T/S & VID. DEL. & VID. REC.
6-8	ATCSF
9-11	ATCSF WITH VID. REC.
12,14,16	LIVE



(1) Manual Data

These consist of the following records:

- . Controller questionnaires (Appendix D)
- . Observer logs
- . Debriefing notes and comments

(2) Automatic Data

These consist of the following:

- . ARTS III extraction, including as a minimum: target reports, tracking messages, and keyboard entries
- . DABS sensor recordings, including as a minimum:
  - DABS to ATC surveillance messages
  - Uplink and downlink messages
- . ARIES data recordings indicating which ATCRBS and DABS targets replied to interrogations.
- . ATCSF data recordings including: messages sent to the IOP and the Video Reconstitutor; true aircraft position, speed, heading and altitude; and "pilot" keyboard entries.
- . Airborne instrumentation digital tape recordings of ranging data.

(3) Photographic Data

Pictures of the controller scope will be taken during the tests, for subsequent viewing and analysis. The pictures will show the whole display or sections thereof, as determined by the test manager. Various display features, especially those which are considerably different from the ARTS III displays, will be photographed.

(4) Playback Capability

A playback capability would enable the rerunning of individual tests under the same surveillance inputs as received and recorded in the original test. The FR-1800 video recording system can be used to record DABS surveillance output for subsequent replay into the ARTS III

system. Although a playback capability is a desirable feature, it is not considered an absolute necessity for the operational evaluation effort. As such, while the test plan does not include any requirements for playback use, the capability, if available, could be a useful test tool. The playback feature is a desirable evaluation tool in that it would make it possible to evaluate the system's repeatability, verify changes and corrections, and determine the effect of changing parameters and/or software logic.

#### 5.1.5.5 Debriefing

At the completion of each test mission, a debriefing session will be held for the purpose of summarizing the test results. A debriefing form (Appendix E) will be completed by each of the participating controllers and observers. In addition, the participants will be encouraged to discuss any comments, suggestions, or problems relative to the specific mission, or, in general, the operational aspects of the combined DABS/ATC system.

#### 5.1.5.6 Mission Report

A mission report will be prepared for each completed mission. This report will include a test description, significant findings, a list of the types of data collected, a summary of the controllers' evaluation, and a summary of the debriefing session.

### 5.2 Phase II: Operational Impact Analysis (Post-TDP)

#### 5.2.1 General

Phase II of the operational evaluation effort will be much broader and more comprehensive than the Phase I effort. Under Phase II, all the five system configurations will be evaluated, as these systems are expected to be completed and checked out prior to commencement of Phase II testing. Phase II includes two major aspects:

- (1) Testing with field controllers. Controllers from various ATC facilities will be invited to NAFEC to participate in the operational evaluation of the integrated DABS/ATC system.

- (2) Analytic evaluation of the operational implications of DABS/ATC. This includes the collection and analysis of quantitative data (e.g., surveillance accuracy), as well as studies aimed at determining the impact on operational issues such as separation requirements, ATC procedures, and controller workload.

The specific areas which are to be evaluated in Phase II are:

- . Effect on current separation requirements
- . Potential for reducing the current separation standards without compromising safety
- . Effect on ATC procedures
- . Surveillance quality (i.e., accuracy of position, accuracy of relative separation, resolution, jitter, blip-scan, false targets, clutter problems, weather accuracy)
- . Controller workload
- . Adequacy of new and changed keyboard entries
- . Quality of new display characteristics
- . Effect on ATC functions (e.g., CA, MSAW)

#### 5.2.2 Methodology

Two types of activities will be conducted: (1) Tests with field controllers, and (2) Analytic evaluation. These are described below.

##### 5.2.2.1 Tests With Field Controllers

Essentially, these tests will be performed in a similar fashion to the controllers' tests described for Phase I. Before the start of the tests, a one-day orientation session will be conducted (see the agenda in Appendix F) in order to introduce the field controllers to the NAFEC test facilities, the concepts of DABS, and the intricacies of the operational evaluation activities.

A minimum of sixteen simulated and live test missions will be conducted, as shown in Figure 5-4, using the five system configurations. Controllers' evaluation data will be collected through inflight and post-flight questionnaires, and comments made in the debriefing sessions, in much the same manner as described above for the Phase I testing.

#### 5.2.2.2 Analytic Evaluation

The analytic evaluation will include the following analyses:

- (1) Results of other related test efforts will be reviewed with the objective of compiling those results which pertain to the operational aspects of the DABS/ATC system. These test efforts will include, in addition to the technical tests conducted at NAFEC, the MTD tests in Burlington Vt., the Tampa/Sarasota system tests, and any other tests which may be found to be relevant.
- (2) Quantitative measurements will be made of the accuracy of the surveillance information as displayed on the controller's scope. This includes measurements of the true vs. displayed aircraft position, the true vs. displayed relative separation between aircraft in close proximity, and other aspects of surveillance quality as it appears to the controller, such as: false targets, jitter, missing targets, and target resolution (i.e., overlapping targets, and targets in clutter).
- (3) Based on the surveillance accuracy results, an analysis will be performed to determine whether the surveillance accuracy of DABS/ATC is consistent with the required ATC separation standards, and, moreover, whether the standards can be reduced without compromising safety.
- (4) An analysis will be made of potential procedural problems and possible improvements to ATC procedures as a result of introducing the DABS/ATC concept. Also, an identification will be made of what revisions will be necessary to the current procedures, and what new procedures may be needed, if any.
- (5) The effect of DABS/ATC on the CA (Conflict Alert) and MSAW (Minimum Safe Altitude Warning) functions will be analyzed from an operational point-of-view, to insure that DABS/ATC does not introduce some features which may adversely affect the performance of these functions.
- (6) An analysis will be made of the increase and/or decrease to the controllers' workload as a result of the changes introduced by the DABS/ATC system.

## 6. DATA REDUCTION AND ANALYSIS (DR&A)

Each mission will yield a large amount of data that must be edited, reduced, analyzed, and reported. This section describes the data processing techniques which will be applied to the various types of collected data, namely: qualitative, quantitative, and photographic data.

### 6.1 Qualitative

The subjective information supplied by the controllers and observers during and after the missions will be compiled and classified for each operationally-significant factor as shown in Table 6-1. In addition, potential problems as well as any specific required improvements as identified by the controllers, will be compiled and presented in the final results.

In addition, the analysis of the inflight live tests will be concerned with comparing the true aircraft relative separation against the displayed separation. This analysis will be accomplished by comparing the true separation as measured and recorded by the Airborne TACAN instrumentation with the separation as observed and estimated by the test controllers. The estimated separation will be recorded manually by the test observer during the test at one-minute time intervals. Subsequently, the deviations between the estimated and TACAN-recorded separation (at matching time instants) will be calculated and plotted.

### 6.2 Quantitative

Quantitative data reduction will be accomplished as part of the Phase II evaluation effort. The purpose of this data reduction will be to obtain quantifiable measures of the surveillance accuracy of the radar data displayed on the controller's scope. The emphasis will be on evaluating the accuracy of the displayed vs. true data, as effected by the aggregate of all subsystem errors including the errors introduced by the radar digitizer, DABS, ARTS III, the display subsystem, and other components such as the Video Reconstitutor and the Video Delay Generator. The following measures will be obtained:

- . True vs. displayed position deviation
- . True vs. displayed relative separation of two aircraft in proximity
- . Blip/scan ratio
- . False targets
- . Target jitter

TABLE 6-1  
REDUCED QUALITATIVE DATA

	Adequacy			Comparison With ARTS III BTL			Comments
	Good	Acceptable	Needs Improvement	Better	Same	Worse	
1. <u>ACCEPTABILITY OF DISPLAYED INFORMATION</u>							
Target Symbols (D/A/S)*							
Data Block Information							
Tabular Lists							
Automatic Offset							
Jitter							
History Trail							
Map Quality							
Range Marks							
Weather Display							
General F/D Display Quality							
Video Display (D/A/S)							
2. <u>KEYBOARD ENTRIES</u>							
Changes to ARTS III Entries							
Usefulness of New Entries							
Frequency of Use							
Response Time							
Effect on Controller Workload							
3. <u>PROCEDURES</u>							
Handling of Handoffs							
Beacon Code Changes							
Flight Plan DABS Address Entry							
Ident							
4. <u>SEPARATION</u>							
Ability to Distinguish Targets (Resolution)							
Ability to Identify Targets							
Ability to Maintain Separation Standards							
Potential for Reducing Separation Standards							

\* DABS/ATCRBS/Search

TABLE 6-1 (Continued)

	Adequacy			Comparison With ARTS III BTL			Comments
	Good	Acceptable	Needs Improvement	Better	Same	Worse	
<b>5. <u>SURVEILLANCE QUALITY</u></b>							
<u>TARGETS</u>							
Split Targets							
False Targets							
Lost Targets							
<u>ACCURACY</u>							
True vs. Displayed Position Accuracy							
True vs. Displayed Separation Accuracy							
Beacon/Radar Registration							
<u>TRACKING</u>							
Coasts							
Drops							
Initiations							
<u>WEATHER</u>							
Displayed vs. True							

The above measures will be grouped by the following classifications:

- . DABS, ATRBS, and search-only targets
- . Tangential and radial flights
- . Small and large aircraft
- . Various ranges from the radar antenna, i.e., 0-10, 10-25, 25-50 nm
- . Presence and lack of ground clutter and precipitation

The reduced data on position and separation accuracy will be expressed in statistical terms of mean and standard deviation, and, in addition, scan-by-scan plots of the true vs. displayed deviations will be provided.

It is likely that some of the measures above will be derived as part of the technical surveillance tests to be conducted at NAFEC. In particular, the blip/scan ratio, false target rate, and target jitter statistics will probably be available from the technical tests. If that is the case, such results will be used, and no additional data reduction will be required. On the other hand, the evaluation of the true vs. displayed position, and the relative separation, are not included in the technical tests, and will have to be accomplished as a separate effort. Basically, such evaluation requires the recording of the true aircraft position, the position as shown on the display and special data reduction to measure the deviations between the two. The required instrumentation is available at NAFEC and has been used in several studies concerned with determining surveillance accuracy (See FAA-RD-73-62; volume I, II, III; Measurement and Analyses of ASR-4 System Error. Also, FAA-RD-76-178, Airspace Configuration and Separation Evaluation Configuration and Procedures, Terminal ATC Digital Display System Errors, ARTS III.)

The NIKE-Hercules radar system at NAFEC may be used as an optional supplement to the operational evaluation effort, provided the availability of the equipment and resources required for data reduction and analysis. The NIKE-Hercules precision X-band tracking radar tracks targets in either a reflected mode (i.e., "skin paint") or a beacon transponder mode. Aircraft position reports are processed in a minicomputer and subsequently recorded on a magnetic tape. This system has been used in several DABS technical tests at NAFEC for evaluating the aircraft positional accuracy under DABS surveillance. A Description of the NIKE-Hercules system can be found in WP-79N00003, "Test Plan for DABS Accuracy Tests", and in FAA-NA-79-32, "NAFEC Range Instrumentation Systems".



## 7. INSTRUMENTATION AND FACILITIES

The following facilities will be required for the operational evaluation effort.

### (1) TATF

The TATF will be used in all the test missions. Normally, one ARTS III system will be used, except that during the inflight live tests, two systems will be used simultaneously to facilitate the "side-by-side" evaluation (see Section 5.1.3.3).

### (2) DABS

The DABS sensor will be used in all the tests, except those missions where DABS is simulated by the ATCSF.

### (3) ATCSF

The ATCSF will be used to simulate DABS, ATCRBS, and search inputs to ARTS III. At least six ATCSF tests will be run--three with F/D displays, and three with T/S displays using the Video Reconstitutor. Simulated pilots will participate in the tests to execute the controllers' ATC instructions. At the present time, the ATCSF software is being modified to provide the required inputs to drive the Video Reconstitutor.

### (4) ARIES

The ARIES will be used to simulate DABS and ATCRBS beacon inputs to the DABS sensor. At least one test requiring the ARIES will be run for each of the five system configurations.

### (5) Test Aircraft

Two NAFEC test aircraft will be used for the inflight live tests. Onboard equipment will include the Hoffman TACAN instrumentation for measuring and recording the relative separation (see Section 4.2, item (9)).

## 8. COORDINATION AND AREAS OF RESPONSIBILITY

The operational evaluation effort will require the participation of a number of different NAFEC and outside organizations. The varied activities that will be undertaken make it imperative that close and continuous coordination be maintained throughout the test effort. The following is an outline of the test participants and support personnel, including their respective areas of responsibility. The organizational assignments are shown in Table 8-1.

### (1) Test Manager

The test manager is responsible for the overall execution of the test effort; scheduling the various activities as described herein; assigning specific tasks to the test participants; scheduling NAFEC resources; and maintaining the proper coordination between the test personnel as well as any other NAFEC and outside organizations (e.g., the Eastern Region for coordinating the live flight tests).

### (2) Test Analysts

Three test analysts will be required to perform the following functions:

- . Develop, update and checkout test scenarios
- . Develop and update test procedures
- . Develop and checkout data reduction tools
- . Prepare questionnaires and log forms
- . Verify that the total system and the various components are ready prior to the actual tests with controllers
- . Develop and present agenda and information items for the controller orientation sessions, pre-test briefings, and debriefing sessions
- . Perform data analyses of the test results
- . Write mission reports and overall test reports

In Phase II, the analysts' job will include--in addition to the above--an analytical evaluation of the effect of DABS/ATC on separation minima and ATC procedures, and a compilation of operationally-relevant data derived from previous technical tests, as discussed in Section 5.2.2.2.

TABLE 8-1  
ORGANIZATIONAL ASSIGNMENTS

	ANA 100A	ANA 210	ANA 520	ANA 240	ANA 640	ANA 750	MITRE	UNIVAC	TEXAS INST.
1. Test Manager	●								
2. Test Analysts	●						●		
3. Test Controllers		●							
4. Test Observers	●	●							
5. Pilots					●				
6. ATCSF Support				●					
7. Technical Support								●	●
8. Photographic Support			●						
9. Display Error Measurements						●			

(3) Test Controllers

The test controllers will provide an evaluation of the radar display characteristics from an operational point-of-view. In addition to filling out the questionnaires and debriefing forms, the controllers will be encouraged to offer any comments, opinions and observations with regard to the merits and demerits of the new DABS/ATC system in general and the five basic system configurations in particular.

During the ATCSF tests, the controllers will assume a more active role--albeit in a simulation exercise--in actually controlling aircraft in simulated Philadelphia Airport environment.

(4) Test Observers

The test observers will assist the controllers by recording any pertinent information observed during the test on the observer log sheet. The observers will also participate in the debriefing sessions and provide their evaluations of the system.

(5) Pilots

The pilots will fly the aircraft in the live-flight tests according to prescribed flight paths. The pilots will be in radio contact with a controller in the TATF to coordinate any deviations from the flight plans or special actions needed for the test (e.g., transponder turn off, ident, etc.)

(6) ATCSF Resources

Support from ATCSF personnel will be needed before and during the tests. Before the tests, the ATCSF software needs to be developed and checked out to insure that the ARTS III and Video Reconstitutor systems receive the proper signals from the ATCSF, and that the full system (i.e., ARTS III/ATCSF/Video Reconstitutor) and the various interfaces operate reliably. During the tests, ATCSF support will be needed in providing the simulated pilots to communicate with the controllers and effect the maneuvers of the simulated aircraft.

(7) Technical Support

To insure the smooth execution of the tests, the ARTS III and DABS contractors (i.e., UNIVAC and Texas Instruments) will be requested to provide technical support as necessary. This support may include monitoring the equipment during the tests, performing data collection and reduction, and verifying that the system is ready for testing in preparation for each mission.

(8) Photographic Support

Coordination with NAFEC's photographic section will be required for allocating the necessary personnel and equipment.

(9) Display Error Measurements

In phase II of the operational evaluation effort, special test instrumentation and data reduction resources will be required to accomplish the measurement of the display errors (i.e., true vs. displayed information) as described in Section 6.2.

This activity will involve the use of specialized test equipment (e.g., Telereadex) and some data reduction packages associated with this equipment. Coordination will be required with the appropriate NAFEC organization in charge of such facilities.

Optionally, depending on the available resources, NAFEC's NIKE-Hercules equipment may be used to provide the positional accuracy of the DABS/ATC system (see Section 6.2).

## 9. SCHEDULES

This section provides tentative schedules for accomplishing the Phase I and II test activities. The major planning consideration governing the schedules is the need to obtain meaningful results prior to the issuance of the DABS TDP, scheduled for April 1980. Since some questions exist relative to the readiness of the various subsystems required to test the five DABS/ATC system configurations, three contingency plans were developed to account for different levels of subsystem availability prior to 4/80. Another major consideration is the need to insure the completion of all technical tests and shakedowns before the system is ready to be presented and used by controllers for operational evaluation. Finally, the schedule for Phase I overlaps the time period allotted for the relocation of NAFEC's technical facilities to the new technical and administrative complex, with a possible impact on the desired schedule.

### 9.1 Phase I

As discussed in Section 5.1.4, the Phase I activities are dependent on the availability of five system configurations. Three contingencies exist:

Contingency I: All subsystems ready before March 1980. A minimum of 16 missions will be required.

Contingency II: Only the Video Delay Generator and the Video Reconstitutor are ready before March 1980. A minimum of 8 missions will be required.

Contingency III: The MTD, the Video Delay Generator, and the Video Reconstitutor are ready before March 1980. A minimum of 12 missions will be required.

The schedules are shown in Figures 9-1, 9-2 and 9-3, respectively.

### 9.2 Phase II

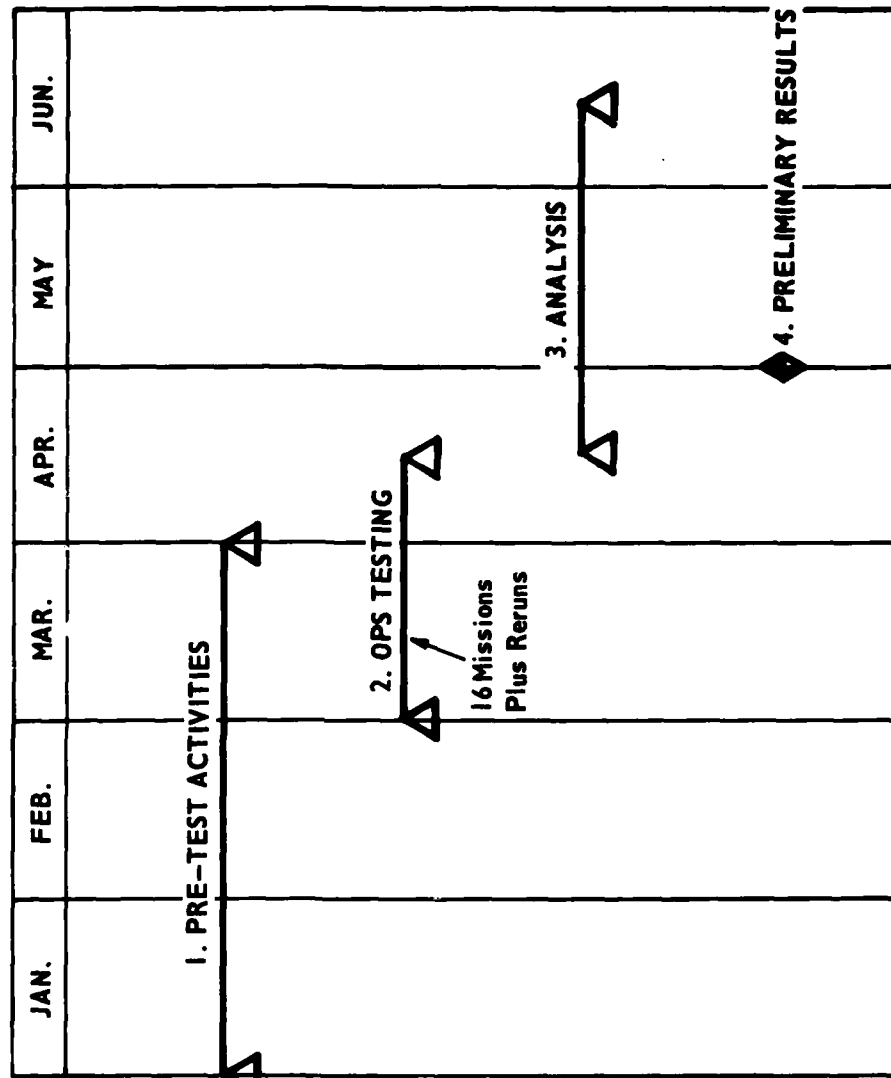
The schedule for Phase II of the DABS/ATC operational evaluation effort is illustrated in Figure 9-4. Phase II is divided into two parts: (1) Tests with field controllers, and (2) Analytic evaluation. The tests with field controllers can start as soon as the five system configurations are ready for operational testing. A minimum of 16 missions will be run, extending over a period of two

weeks. As an option, a second controller team will be invited, in order to provide more evaluation data. Subsequently, an analysis of the test results will be conducted.

The operational evaluation effort will be accomplished in parallel with the field-controllers tests. A final report will be issued summarizing the findings of both parts of the activity.

FIGURE 9-1  
CONTINGENCY PLAN I

ASSUMPTION : ALL SUBSYSTEMS READY BEFORE MARCH 1980



1. PRE-TEST ACTIVITIES
- Write Test Procedures
  - Testbed Shakedown
  - Develop DR&A Tools
  - Develop/Test ATCSF and ARIES Scenarios
  - Prepare Questionnaires
  - Develop New SW



FIGURE 9-2

CONTINGENCY PLAN II

ASSUMPTION: ONLY THE VIDEO DELAY GENERATOR AND THE VIDEO RECONSTITUTOR ARE READY BEFORE MARCH 1980

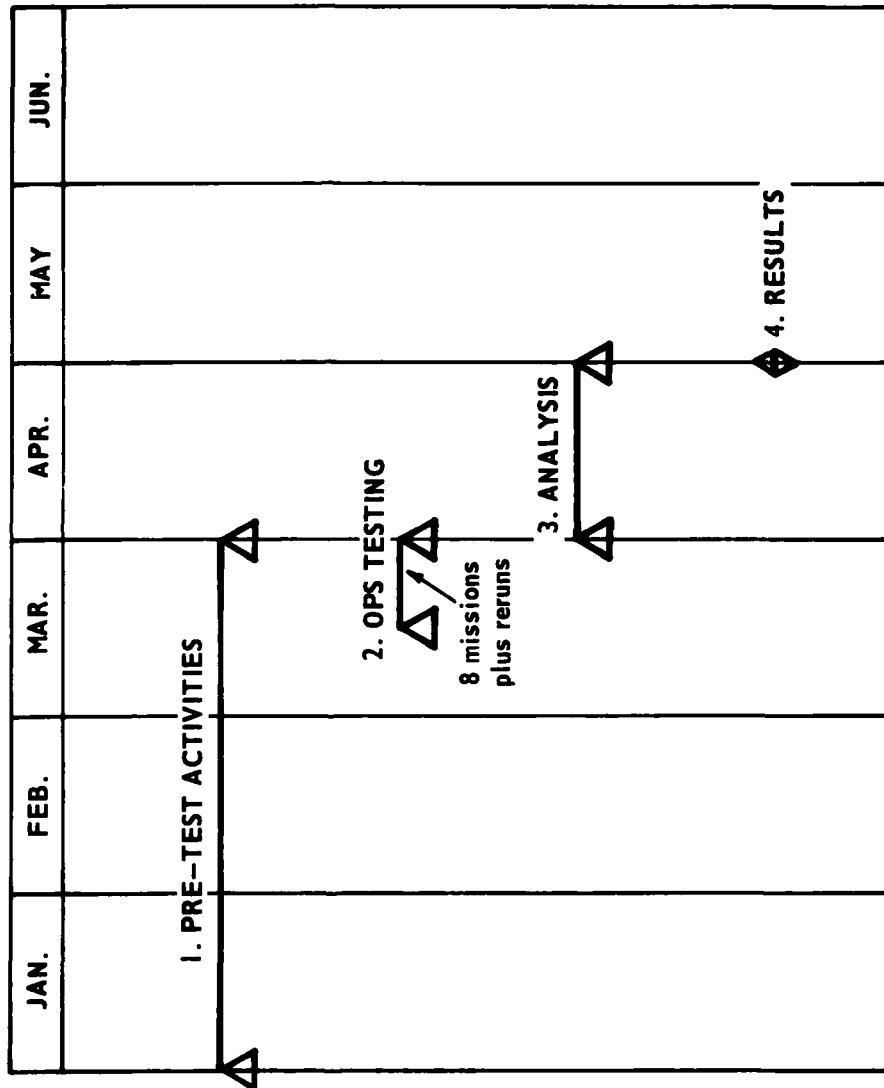


FIGURE 9-3

CONTINGENCY PLAN III

ASSUMPTION : THE MTD, VIDEO DELAY GENERATOR, AND VIDEO RECONSTITUTOR ARE READY BEFORE MARCH 1980

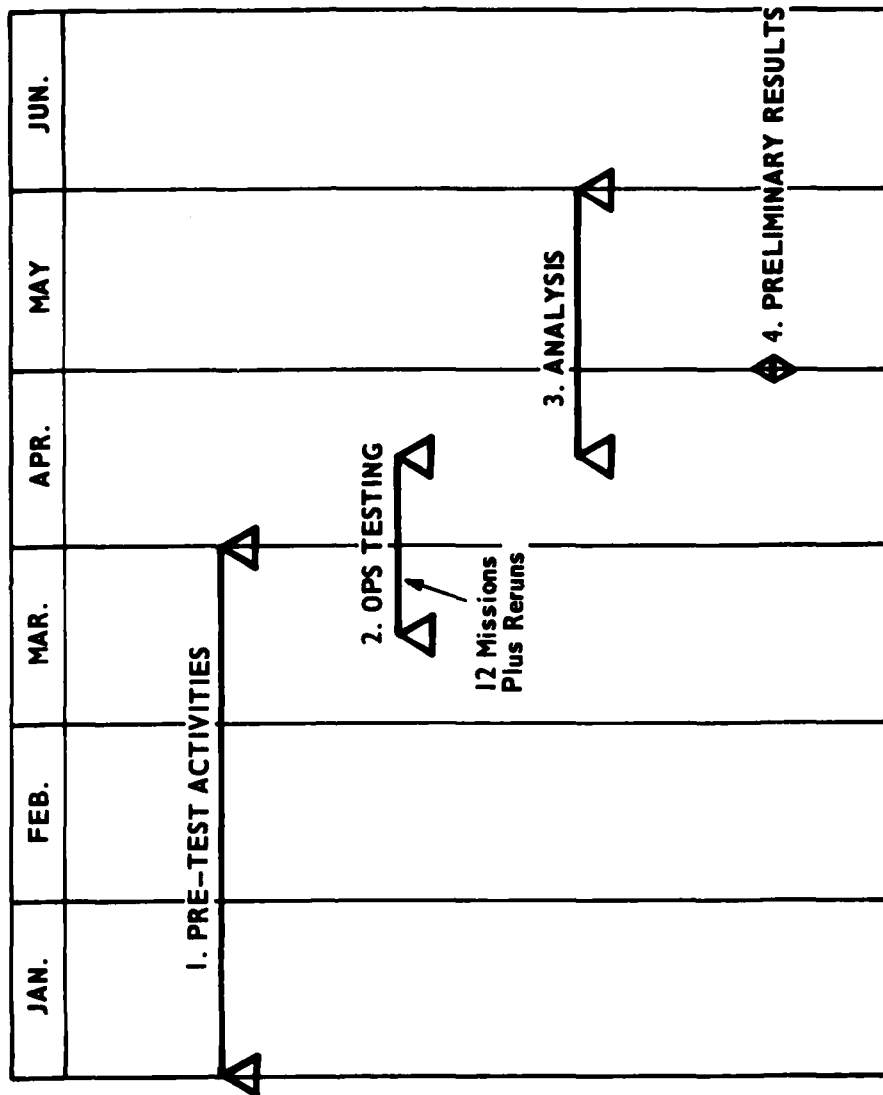
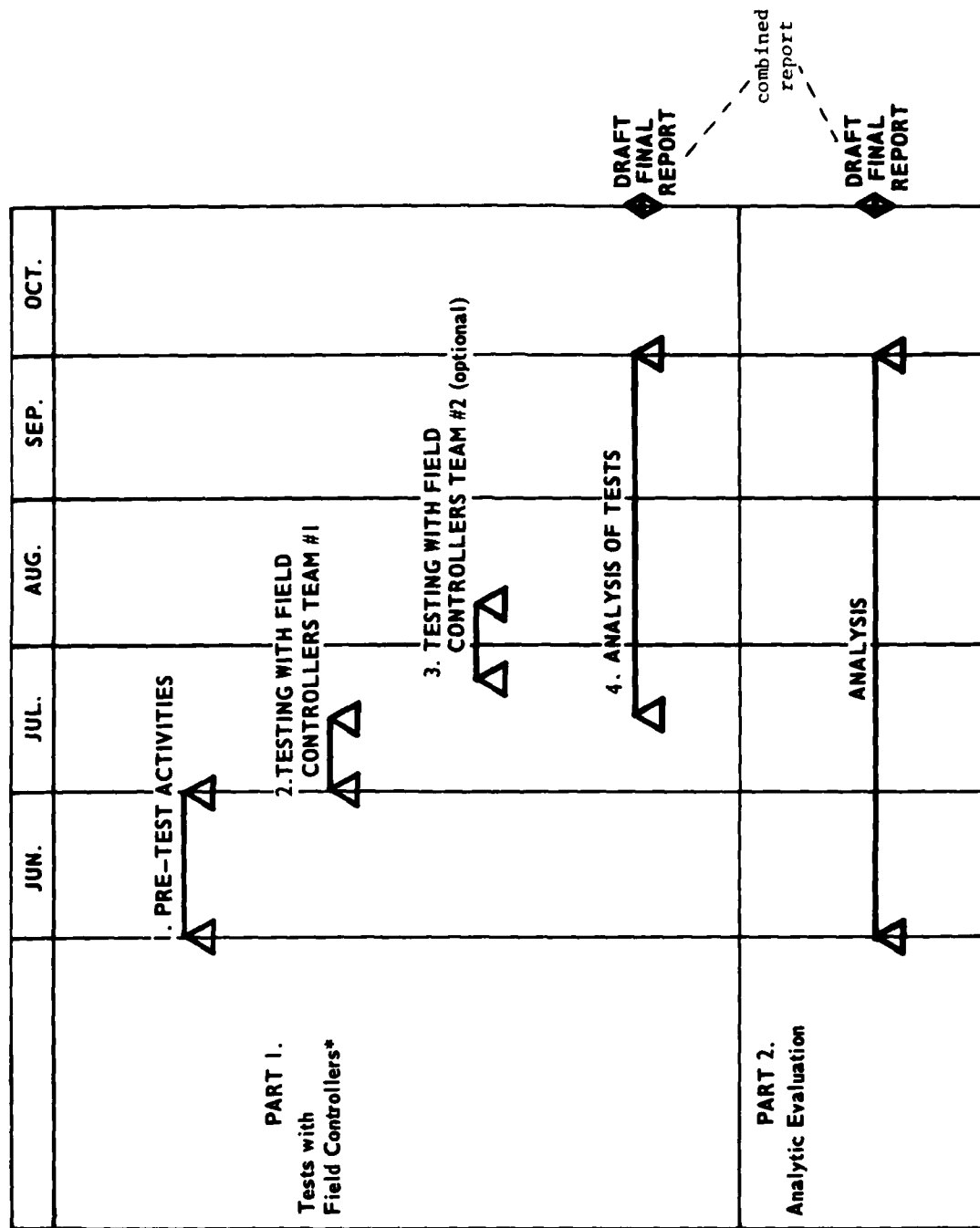


FIGURE 9-4

SCHEDULE FOR PHASE II



\*This schedule is based on the assumption that the five system configurations are available for operational testing before July 1980. If this is not the case, the schedule will be modified accordingly.

APPENDIX A  
ARIES TEST SCENARIO

AIRCRAFT ID  
 DEPARTURES  
 ENROUTE  
 ARRIVALS  
 SPEED  
 ALTITUDE  
 GENERAL EQUIP.  
 TIME  
 RTGS CODE  
 ALC TYPE  
 DARS CODE  
 RWD START

UA123	1	3	2	250	45K	10	00	00	00	0411	8707	000411	DABS OPERATIONAL
N190RM	1	1	180	50U	6	00	02	00	00	3370	PA31	000206	
N6681	1	1	250	45K	10	00	01	00	00	0501	8727	010581	
UA124	1	250	60K	10	00	03	00	00	00	2010	8727	020204	TEST
AL22	4	200	60U	10	00	05	00	00	00	2011	8727	020210	
M323EC	2	160	60K	6	00	06	00	00	00	1754	M265	000212	
AA704	3	2	250	45U	10	00	06	00	00	1013	0C8	001013	ARIES SAMPLE
N400HA	9	160	40K	6	00	07	00	00	00	2012	8E18	020214	
AC4746	3	180	40U	6	00	08	00	00	00	2013	MC6	020220	
EA571	1	1	250	45U	10	00	09	00	00	0711	0C10	010751	
TA235	1	250	60K	10	00	10	00	00	00	2014	8707	020224	
N22MS	13	180	50U	6	00	11	00	00	00	3077	8E36	000216	
RA4997	6	180	40U	6	00	12	00	00	00	2015	M026	020230	
RC411	3	2	250	45K	10	00	12	00	00	0406	0C9	000406	
M330CC	19	180	60K	6	00	13	00	00	00	4350	C500	000222	
TA17	2	250	60K	10	00	14	00	00	00	2016	8707	020234	
N2274	1	1	250	45K	10	00	15	00	00	0322	LP24	000888	
EA506	1	250	60K	10	00	17	00	00	00	2017	8727	020240	
M37221	3	180	60U	6	00	18	00	00	00	4266	C310	000226	
TA247	3	2	250	45U	10	00	18	00	00	0405	8727	000405	
N27AC	4	250	60U	10	00	20	00	00	00	2020	FFJ	020244	
NAAT	1	240	50K	10	00	21	00	00	00	2755	LR25	000232	
UA643	1	1	250	45K	10	00	21	00	00	0502	0C9	000C00	
PL324	3	250	60K	10	00	23	00	00	00	2021	8727	020250	
NR6478	13	200	50U	8	00	24	00	00	00	2742	C340	000236	
EA579	3	2	250	45K	10	00	24	00	00	1130	0C9	001130	
N710TK	19	160	60K	6	00	27	00	00	00	3354	8E90	000242	
AA703	1	1	250	45U	10	00	27	00	00	0712	8707	01071F	
N4780	1	250	80U	10	00	27	00	00	00	2022	8727	020205	
N4668	2	120	40U	4	00	30	00	00	00	4303	PA28	000246	
N4785	3	2	250	45U	10	00	30	00	00	0402	8727	000402	
AL131	1	250	60K	10	00	30	00	00	00	2023	0C9	020211	
N4025U	3	120	60K	4	00	32	00	00	00	4362	PA28	000252	
PC24	1	1	250	45K	10	00	33	00	00	0323	0C9	000000	
UA7208	3	250	60K	10	00	36	00	00	00	2024	8727	020215	
UA702	3	2	250	45U	10	00	36	00	00	1007	0C10	001007	
M37223	13	180	50U	6	00	37	00	00	00	0306	C310	000323	
N4536	4	250	40K	10	00	37	00	00	00	2025	8727	020221	
EA560	1	1	250	45U	10	00	39	00	00	0503	8727	010503	
N7669C	14	160	50K	6	00	40	00	00	00	0522	AC50	000327	
N8187	3	190	40U	6	00	40	00	00	00	2026	C310	020225	
RC405	3	2	250	45K	10	00	42	00	00	1123	0C9	001123	
N340	3	190	60U	6	00	43	00	00	00	4366	8E58	000333	
BN344	1	230	60K	10	00	43	00	00	00	2027	8727	020231	
NW75	1	1	250	45K	10	00	45	00	00	0713	0C8	000FEF	
M82210	1	180	50K	6	00	46	00	00	00	4305	PAYE	000337	
AA351	3	250	60K	10	00	47	00	00	00	2030	8727	020235	
AA707	3	2	250	45K	10	00	48	00	00	1016	8727	001016	
M7583F	19	180	60U	6	00	50	00	00	00	4344	C402	000343	
EA611	9	250	60U	10	00	50	00	00	00	2031	8727	020241	
UA142	1	1	250	45K	10	00	51	00	00	0324	0C10	000FFF	
TA843	3	2	250	45U	10	00	54	00	00	1001	0C8	001001	

SL827	1	2	1	250	60K	10	00	54	00	2032	0C9	020245
M161SA				180	40K	6	00	55	00	3464	PA31	000347
RC600			1	1	250	45U	10	00	57	00	0504	0C9 010504
AL258	8			250	60U	10	00	57	00	2033	0C9	020251
M8153R		13		160	50U	6	00	58	00	5564	BE55	000353
M722W		3		180	60K	8	01	00	00	7154	C310	000157
MU15			3	2	250	45K	10	01	00	1012	8707	001012
N50X	4			170	40U	6	01	00	00	2034	BE23	020255
M481T			1	1	250	45K	10	01	03	00	0714	LR24 00A4AA
M6526B		1		160	50U	6	01	04	00	3430	C310	000365
N1575	1			140	60K	4	01	04	00	2035	C130	020261
M333K			3	2	250	45K	10	01	06	00	0420	LR24 000420
AL395	4			210	60K	8	01	06	00	2036	PA11	020265
N235		19		160	60K	6	01	09	00	5325	PA23	000367
UA501			1	1	250	45U	10	01	09	00	0324	8727 010324
AA237	1			250	80U	10	01	10	00	2037	8727	020271
EA722			3	2	250	45U	10	01	12	00	1144	0C9 001144
N2761H		14		180	50U	8	01	13	00	5373	C310	000373
EA847	3			250	60K	10	01	13	00	2040	8727	020275
TW11			1	1	250	45K	10	01	15	00	0505	AC10 00F0C0
N90F		2		160	60K	6	01	17	00	2766	PA5E	000377
EA123	9			250	60U	10	01	17	00	2041	8727	020301
UA711			3	2	250	45K	10	01	18	00	1134	0C10 001134
N265	8			250	80U	9	01	20	00	2042	L329	020305
N732HF		13		160	50U	6	01	21	00	5362	C210	000403
MW62			1	1	250	45U	10	01	21	00	0715	8707 010715
AA342			3	2	250	45U	10	01	24	00	0410	8727 000410
RAN970	3			200	60K	8	01	24	00	2043	N26	020311
N2093A		3		140	60K	4	01	25	00	4263	PA28	000407
EA647			1	1	250	45K	10	01	27	00	0325	0C8 008C8D
M972TF	1			250	60K	10	01	27	00	2044	AC21	020315
N55ES		1		180	50U	8	01	29	00	1654	C310	000413
RC471			3	2	250	45K	10	01	30	00	0441	0C9 000441
UA91	9			250	80U	10	01	31	00	2045	8727	020321
N115K		19		180	60K	6	01	33	00	4022	C500	000417
AA12			1	1	250	45K	10	01	33	00	0506	0C10 00128C
N759W	4			160	80U	6	01	35	00	2046	C182	020325
TW68			3	2	250	45U	10	01	36	00	0431	8727 000431
M743UG		14		180	50U	8	01	37	00	6662	G159	000423
MW782	3			250	120K	10	01	38	00	2047	8727	020331
UA144			1	1	250	45U	10	01	39	00	0716	0C8 0007AD
N7144N		2		160	60U	6	01	40	00	2734	BE35	000427
N77PPU			3	2	250	45K	10	01	42	00	0436	LR24 000436
AL416	5			230	80U	9	01	42	00	2050	BA11	020335
M66AT		13		180	50U	6	01	43	00	2003	BE90	000433
N47			1	1	250	45K	10	01	45	00	0326	LR24 000326
M1841D		3		160	60K	6	01	46	00	4262	G2	000437
AL114	6			250	80K	10	01	46	00	2051	0C9	020341
M37KC		1		160	50U	6	01	49	00	0310	C337	000324
EA963	9			250	100K	10	01	50	00	2052	L101	020345
N333K0		19		180	60K	8	01	52	00	4217	AC6T	000330
M27272		14		160	50U	4	01	55	00	3125	PA31	000334

A-3

APPENDIX B  
ATCSF TEST SCENARIOS

SCENARIO #1 - HEAVY LOAD

See Pages B-2 to B-4

SCENARIO #2 - MEDIUM LOAD

This scenario will be a subset of Scenario #1.

R/C GRAF	DEPARTURE TIME	BARRIERS	SPEED	ALTITUDE	BEACON EQUIP.	TIME	AIR CDS CODE	AIR TYPE	DABS CODE	DABS VER	STREET	
UA123	1	3	2	250	100K	10	01	00	0411 B707	000411	1	DABS OPERATIONAL
N180RM	1	1	180	500	6	01	02	00	3370 PA31		1	
N1	1	1	180	450	4	01	03	00	1200 PA2R		1	
N4081	1	1	250	100K	10	01	03	00	0501 A727	0105R1	1	
UA124	1	13	250	20K	10	01	03	00	2010 B727	020204	1	TEST
N2761M	4	13	160	50	6	01	03	00	PA23		1	
AL22	4	2	200	20U	10	01	05	00	2011 B727		1	
N123EC	2	2	160	60K	6	01	05	00	1754 N265	000212	1	
AA704	1	3	2	250	100U	10	01	06	1013 DC8		1	
N4244C	1	3	180	45K	6	01	06	00	1200 C182	1-00440	1	ATCSF
N400NA	9	1	160	20K	5	01	07	00	2012 BE1A	020214	1	
N469	3	26	160	60	6	01	07	00	PA23		1	
ACW746	3	180	20U	6	01	08	00	00	2013 DHC6		1	HEAVY SAMPLE
N854MA	13	180	35K	6	01	08	00	00	1200 C182	000434	1	
EA573	1	1	250	100U	10	01	09	00	0711 DC10		1	
N20A	29	1	160	60	5	01	10	00	PA23		1	
TW235	1	250	20K	10	01	10	00	00	2014 P707	020224	1	
N572	13	163	45U	6	01	11	00	00	1200 C1R2		1	
N224S	13	180	50U	6	01	11	00	00	3077 BE36		1	
RA4997	6	180	20U	6	01	12	00	00	2015 N026		1	
RC411	1	3	2	250	100K	10	01	12	0406 DC9	000406	1	
N130CC	19	180	60K	6	01	13	00	00	4350 C500	000222	1	
TW17	2	250	20K	10	01	14	00	00	2016 B707	020234	1	
N93A	19	160	50	6	01	14	00	00	PA23		1	
N2274	1	1	250	100K	10	01	15	00	0322 LR24	00RRBB	1	
N573	1	160	55U	6	01	15	00	00	1200 C182		1	
E4506	1	250	20K	10	01	17	00	00	2017 B727	020240	1	
N57221	3	180	60U	6	01	18	00	00	4266 C110	000226	1	
TW247	2	3	2	250	100U	10	01	18	0405 B727		1	
N31926	27	160	60	5	01	18	00	00	PA23		1	
N27AC	4	250	20U	10	01	20	00	00	2020 CFJ		1	
N9AT	1	240	50K	10	01	21	00	00	2755 LR25	000332	1	
UA643	1	1	250	100K	10	01	21	00	0502 DC9	00CCCC	1	
M2605H	14	1	160	50	6	01	21	00	PA23		1	
N574	26	160	65U	6	01	22	00	00	1200 C182		1	
DL324	3	250	20K	10	01	23	00	00	2021 B727	020250	1	
N2647K	13	200	50U	8	01	24	00	00	2742 C340		1	
EA579	1	3	2	250	100K	10	01	24	1130 AC9	001130	1	
N115K	26	180	45K	6	01	25	00	00	1200 C1R2	000430	1	
N7101K	19	160	60K	6	01	27	00	00	3354 BE90	000242	1	
AA703	1	1	250	100U	10	01	27	00	0712 B707		1	
NW780	1	250	20U	10	01	27	00	00	2022 B727		1	
N575	29	160	75U	6	01	29	00	00	1200 C182		1	
N4466X	2	120	40U	4	01	30	00	00	4503 PA28		1	
AL131	1	250	20K	10	01	30	00	00	2023 AC9	020211	1	
NW7R5	1	3	2	250	100U	10	01	30	0402 B727		1	
N389	13	160	50	6	01	30	00	00	PA23		1	
N4025W	3	120	60K	4	01	32	00	00	4362 PA28	000252	1	
RC24	3	1	250	100K	10	01	33	00	0323 DC9	000600	1	
UA7208	3	250	20K	10	01	34	00	00	2024 B727	020215	1	
N759WU	28	160	60	6	01	35	00	00	PA23		1	
UA702	1	3	2	250	100U	10	01	36	1007 AC10		1	
N37223	13	180	50U	6	01	37	00	00	0306 C310		1	



NW536	2		250	20K	10	01	37	00	2025	8727	020221	1
N576		28	160	45U	6	01	38	00	1200	C182		1
EA560			1	1	250	100U	10	01	39	00	0503	8727
N756WC	14		160	50K	6	01	40	00	0522	AC50	000327	1
N41RT	3		190	20U	6	01	40	00	2026	C310		1
N9044V	13		160	50	6	01	40	00		PA23		1
N2053V	29		180	55K	6	01	40	00	1200	BE58	000414	1
RC405		3	2	250	100K	10	01	42	00	1123	DC9	001123
N3AD	3		190	60U	6	01	43	00	4366	BE58		1
N4144	1		230	20K	10	01	43	00	2027	8727	020231	1
NW75		1	1	250	100K	10	01	45	00	0713	DC8	00EEEE
N46A	26		160	60	6	01	45	00		PA23		1
N577	19		160	65U	6	01	45	00	1200	C182		1
N2210		1	180	50K	6	01	46	00	4305	PAYE	000337	1
AA351	3		250	20K	10	01	47	00	2030	8727	020235	1
AA707		3	2	250	100K	10	01	48	00	1016	8727	001016
N783F	19		180	60U	6	01	50	00	4344	C402		1
EA611	9		250	20U	10	01	50	00	2031	8727		1
UA142		1	1	250	100K	10	01	51	00	0324	AC10	00FFFF
YR43		3	2	250	100U	10	01	54	00	1001	DCR	
DL827	1		250	20K	10	01	54	00	2032	DC9	020245	1
N161SA	2		180	40K	6	01	55	00	3464	PA31	000347	1
N427	19		160	50	6	01	56	00		PA23		1
N364	2		160	45K	6	01	56	00	1200	PA28	000433	1
N578	2		160	55U	6	01	56	00	1200	C182		1
AL258	8		250	20U	10	01	57	00	2033	AC9		1
RC600		1	1	250	100U	10	01	57	00	0504	DC9	
N4153R	13		160	50U	6	01	58	00	5564	BE55		1
N722W	3		180	60K	8	02	00	00	7354	C310	000357	1
N50X	4		170	20U	6	02	00	00	2034	BE23		1
NW15		3	2	250	100K	10	02	00	1012	A707	001012	1
N978	29		160	60	6	02	02	00		PA23		1
N481T		1	1	250	100K	10	02	03	00	0714	LR24	00AAAA
N6526P	1		160	50U	6	02	04	00	3430	C210		1
N1575	1		140	20K	4	02	04	00	2035	C130	020261	1
AL395	4		210	20K	8	02	06	00	2036	8A11	020265	1
N333X		3	2	250	100K	10	02	06	00	0420	LR24	000420
N235	19		160	60K	6	02	09	00	5325	PA23	000367	1
UA501		1	1	250	100U	10	02	09	00	0324	8727	1
N411	19		180	50	6	02	10	00		PA23		1
AA237	1		250	20U	10	02	10	00	2037	8727		1
N579	1		160	35U	6	02	10	00	1200	C182		1
EA722		3	2	250	100U	10	02	12	00	1144	DC9	
N2761M	14		180	50U	8	02	13	00	5373	C310		1
EA847	3		250	20K	10	02	13	00	2040	8727	020275	1
TM11		1	1	250	100K	10	02	15	00	0505	DC10	0018C0
N412	13		180	50	6	02	16	00		PA23		1
N90F	2		160	60K	6	02	17	00	2766	PASF	000377	1
EA125	9		250	20U	10	02	17	00	2041	8727		1
UA711		3	2	250	100K	10	02	18	00	1134	DC10	001134
N265	8		250	20U	9	02	20	00	2042	L329		1
N413	28		180	50	6	02	20	00		PA23		1
N34E	1		180	55K	6	02	20	00	1200	C182	000410	1

N732M	13	1	160	500	6	02	21	00	3362	C210	1
NW62			1	250	1000	10	02	21	00	0715	B707
N580	28		160	450	6	02	22	00	1200	C182	1
AA342		3	2	250	1000	10	02	24	00	0410	B777
PAN970	3		200	200	9	02	24	00	2043	N026	020311
N2093A		3	140	600	6	02	25	00	4263	PA28	000407
N9721	1		250	200	10	02	27	00	2044	AC21	020315
EA647		1	1	250	1000	10	02	27	00	0325	DC8
N414	2		180	50	6	02	28	00		PA23	
N581	19		160	350	5	02	28	00	1200	C182	1
N55ES	1		180	500	8	02	29	00	1654	C310	1
RC471		3	2	250	1000	10	02	30	00	0441	DC9
UA91	9		250	200	10	02	31	00	2045	B727	1
N895R	28		180	450	6	02	31	00	1200	C182	000427
N115K	19		180	600	6	02	33	00	4022	C500	000417
AA12		1	1	250	1000	10	02	33	00	0506	DC10
N415	1		180	50	6	02	33	00		PA23	
N5R2	14		160	450	6	02	33	00	1200	C182	1
N750W	4		160	200	6	02	35	00	2046	C182	1
W08		3	2	250	1000	10	02	36	00	0431	B727
N743UG	14		180	500	8	02	37	00	6662	G159	1
NV7R2	3		250	200	10	02	38	00	2047	R727	020331
UA144		1	1	250	1000	10	02	39	00	0716	DC8
N416	14		180	50	6	02	39	00		PA23	
N714LN	2		160	600	6	02	40	00	2734	BE35	1
N11MR	29		180	350	6	02	40	00	1200	BE58	000423
N583	13		160	650	6	02	40	00	1200	C182	1
AL416	5		230	200	9	02	42	00	2050	PA11	1
N778PW		3	2	250	1000	10	02	42	00	0436	LR24
N86AT	13		180	500	6	02	43	00	2003	BE90	1
N584	2		160	450	6	02	43	00	1200	C182	1
N47		1	1	250	1000	10	02	45	00	0326	LR24
N417	27		180	50	6	02	45	00		PA23	
N585	26		160	550	6	02	45	00	1200	C182	1
N18410	3		160	600	6	02	46	00	4262	G2	000437
AL114	6		250	200	10	02	46	00	2051	DC9	020341
N37FC	1		160	500	6	02	49	00	0310	C337	1
EA963	9		250	200	10	02	50	00	2052	L101	020345
N418	28		180	50	6	02	53	00		PA23	1
N586	28		160	650	6	02	53	00	1200	C182	1
N333KD	19		180	600	8	02	52	00	4217	AC6T	000330
N419	26		180	50	6	02	53	00		PA23	1
N27272	14		140	500	6	02	55	00	3125	PA31	1
N420	14		180	50	6	02	55	00		PA23	1

B-4

FAR AIR TRAFFIC BEING  
PROVIDED IN ACCORDANCE  
ANNEX 11 OF ICAO  
NOT APPLICABLE  
ENCOURAGED

APPENDIX D  
CONTROLLER QUESTIONNAIRE FORM

DATE:

MISSION START TIME:

END TIME:

MISSION DESCRIPTION:

WEATHER:

CONTROLLER:

OBSERVER:

DISPLAY POSITION:

## CONTROLLER EVALUATION OF TARGET SYMBOL

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS (*)
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

### ASSOCIATED TRACKS

DABS

ATCRBS

## SEARCH

## UNASSOCIATED TRACKS

DABS 

MODE C NON-SELECTED \*

NON-MODE C NON-SELECTED +

MODE C SELECTED ☐

NON-MODE C SELECTED △

SEARCH /

## UNTRACKED TARGETS

F/D ONLY .

## GENERAL

OVERALL QUALITY OF TARGET  
SYMBOL DISPLAY

SHOULD ANY SYMBOLS BE CHANGED?

ARE SYMBOLS EASILY  
DISTINGUISHABLE?

REMARKS: (\*)

(\*) Attach additional sheets if more space is needed.

CONTROLLER EVALUATION OF DISPLAYED DATA BLOCK

FULL DATA BLOCK  
(Associated Tracks)

DABS  
ATCRBS  
SEARCH

LIMITED DATA BLOCK  
(Unassociated Tracks)

DABS  
ATCRBS  
SEARCH

PARTIAL DATA BLOCK  
(Associated Tracks Within  
Filter Limits)

DABS  
ATCRBS  
SEARCH

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

GENERAL

OVERALL QUALITY OF DATA BLOCK  
INFORMATION

SHOULD ANY FIELD BE CHANGED?

SHOULD ANY FIELD BE DELETED?

SHOULD ANY FIELD BE ADDED?

REMARKS:

## CONTROLLER EVALUATION OF TABULAR LISTS

DABS  
ATCRBS  
SEARCH

DABS  
ATCRBS  
SEARCH

DABS  
ATCRBS  
SEARCH

DABS  
ATCRBS  
SEARCH

OVERALL QUALITY OF TABULAR  
LISTS

SHOULD ANY LIST INFORMATION  
BE CHANGED?

## REMARKS:

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

CONTROLLER EVALUATION OF AUTOMATIC OFFSET AND JITTER

AUTOMATIC OFFSET

ASSESS GENERAL QUALITY OF  
AUTO OFFSET

NOTE ANY INSTANCES OF  
AUTO OFFSET PROBLEMS

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

JITTER

NOTE IF ANY NOTICEABLE OR  
DISTRACTING DISPLAY JITTER  
(I.E., TARGET POSITION OR  
OTHER) HAS OCCURRED

REMARKS:



CONTROLLER EVALUATION OF HISTORY TRAIL AND PREDICTED POSITION

HISTORY TRAIL

DABS

ATCRBS

SEARCH

PREDICTED POSITION

DABS

ATCRBS

SEARCH

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

GENERAL

OVERALL QUALITY OF HISTORY  
TRAILS?

SHOULD THE HISTORY TRAIL BE  
CHANGED IN ANY WAY?

OVERALL QUALITY OF THE  
PREDICTED POSITION DISPLAY?

USEFULNESS OF THE PREDICTED  
POSITION?

REMARKS:



CONTROLLER EVALUATION OF GENERAL F/D DISPLAY QUALITY

GENERAL F/D DISPLAY QUALITY:

CLARITY

BRIGHTNESS

RESOLUTION

LACK OF RADAR SWEEP

RADAR CLUTTER

SPI

OTHER (ADD):

REMARKS:

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

CONTROLLER EVALUATION OF VIDEO DISPLAY (RAW AND RECONSTITUTED)

VIDEO DISPLAY

SIZE

DABS

ATCRBS

SEARCH

STRENGTH

DABS

ATCRBS

SEARCH

CLUTTER

GENERAL

OVERALL QUALITY OF VIDEO  
DISPLAY

SHOULD ANY VIDEO DISPLAY  
CHARACTERISTIC BE CHANGED?

ADDED?

ELIMINATED?

REMARKS:

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS / SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

CONTROLLER EVALUATION OF KEYBOARD ENTRIES

KEYBOARD ENTRIES:

METHOD OF IDENTIFYING DABS  
TRACKS  
RESPONSE TIME  
FREQUENCY OF USE  
EFFECT ON CONTROLLER  
WORKLOAD

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

GENERAL

OVERALL QUALITY OF KEYBOARD  
ENTRIES  
SHOULD ANY ENTRIES BE CHANGED?  
ADDED?  
DELETED?

REMARKS:

CONTROLLER EVALUATION OF THE EFFECT ON ATC PROCEDURES

PROCEDURES

HANDLING OF HANDOFFS  
 BEACON CODE CHANGES  
 ENTRY OF DABS ADDRESS IN  
 FLIGHT PLAN  
 IDENT REQUESTS

GENERAL

ASSESS THE EFFECT OF DABS/  
 ATC ON TERMINAL PROCEDURES

REMARKS:

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

CONTROLLER EVALUATION OF EFFECT ON SEPARATION REQUIREMENTS

SEPARATION:

ABILITY TO DISTINGUISH  
TARGETS (RESOLUTION)

ABILITY TO IDENTIFY TARGETS

ABILITY TO MAINTAIN  
SEPARATION STANDARDS

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

GENERAL:

OVERALL SEPARATION ABILITY  
WITH DABS

ANY FACTORS WHICH MAY REQUIRE  
EXTRA SEPARATION?

WHAT IS THE POTENTIAL FOR  
REDUCING THE SEPARATION  
STANDARDS?

REMARKS:

## CONTROLLER EVALUATION OF SURVEILLANCE QUALITY

ADEQUACY			COMPARISON WITH ARTS III BTL			COMMENTS/ SUGGESTIONS
GOOD	ACCEPTABLE	NEEDS IMPROVEMENT	BETTER	WORSE	SAME	

## SURVEILLANCE QUALITY

### FREQUENCY OF SPLIT TARGETS

### FREQUENCY OF FALSE TARGETS

### FREQUENCY OF LOST TARGETS

### BEACON/RADAR REGISTRATION

### FREQUENCY OF TRACK COASTS

### FREQUENCY OF TRACK DROPS

## TRACK INITIATION

GENERAL:

**GIVE AN OVERALL ASSESSMENT  
OF THE SURVEILLANCE QUALITY**

LIST ANY SURVEILLANCE  
PROBLEMS YOU OBSERVED

## REMARKS :



APPENDIX E  
DEBRIEFING FORM

DATE:

MISSION START TIME:

END TIME:

MISSION DESCRIPTION:

WEATHER:

EVALUATOR:

FUNCTION (Controller, Observer, or Other):

DISPLAY POSITION:

On a scale of 1 to 5, rate DABS/ATC performance as compared with today's ARTS III system:

5 4 3 2 1

Much improved  
over ARTS III

Similar to  
ARTS III

Worse than  
ARTS III

EVALUATION AREA	RATE	Describe(*) Improvements (if any) Over ARTS III	Describe (*) Deficiencies If Any as Compared with ARTS III	Comments (*)
<u>DISPLAYS</u>				
TARGET POSITION				
DATA BLOCKS				
WEATHER				
MAP				
TABULAR LISTS				
GENERAL DISPLAY QUALITY				
OTHER				

(\*) Attach additional sheets if more space is needed.

<u>EVALUATION AREA</u>	<u>Rate</u>	<u>Describe Improvements (if any) Over ARTS III</u>	<u>Describe Deficiencies If Any as Compared with ARTS III</u>	<u>Comments</u>
<u>SURVEILLANCE</u>				
<u>DETECTION</u>				
TARGET DETECTION				
FALSE TARGETS				
MISSING TARGETS				
OTHER				
<u>ACCURACY</u>				
POSITION ACCURACY (if noted)				
SEPARATION ACCURACY (if noted)				
WEATHER ACCURACY (if noted)				
OTHER				
<u>TRACKING</u>				
COASTS				
TRACK DROPS				
TRACK INITIATION				
<u>CONTROLLER WORKLOAD</u>				
(1) VOICE COMMUNICATIONS				
(2) KEYBOARD ENTRIES				
(3) OTHERS				

QUESTIONS

1. Was the mission suitable for evaluating the operational implications of DABS/ATC?

Please explain:

2. In your opinion, can today's separation standards be maintained with DABS/ATC?

Please explain:

3. Do you think that with the improved surveillance of DABS, a potential exists for reducing today's separation standards?

Please explain:

4. Please state the improvements which DABS/ATC provides relative to today's ARTS III system?
5. Please state any problems or potential problems which exist, in your opinion, in the DABS/ATC system.
6. Do you foresee any potentially serious ATC problems and/or disadvantages which may develop should DABS/ATC (as configured in today's mission) be implemented in the field?

Please explain:

7. Does the DABS/ATC system increase, decrease, or make no difference relative to the workload of the ATC controller?

Please explain:

8. What new ATC procedures, if any, will be needed if DABS/ATC were implemented in the field?

9. To what degree do you feel would replacement of today's ARTS III system with DABS/ATC, as configured in today's mission, enhance the terminal ATC operations?

Please explain:

10. Do you have any additional comments on the adequacy of the DABS/ATC system?

11. Do you have any suggestions on what improvements should or could be made to DABS/ATC?

APPENDIX F  
FIELD-CONTROLLER ORIENTATION AGENDA

1. Objectives of the operational evaluation
2. General description of DABS
3. Major differences between DABS and ARTS III
4. New display characteristics
5. New keyboard entries
6. Test vehicles: ARIES and ATCSF
7. Description of the operational evaluation missions
8. Philadelphia Airport environment and procedures
9. Review of questionnaires, debriefing forms, and log sheets
10. Major areas that are subject to operational evaluation
11. Demonstration of DABS/ATC equipment